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APRIL, 1949

Applied HYDRAULICS

The Magazine of Hydraulic and Air Circuit Engineering

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BREAKING THE FINAL PRODUCTION BOTTLENECK, PAGE 20

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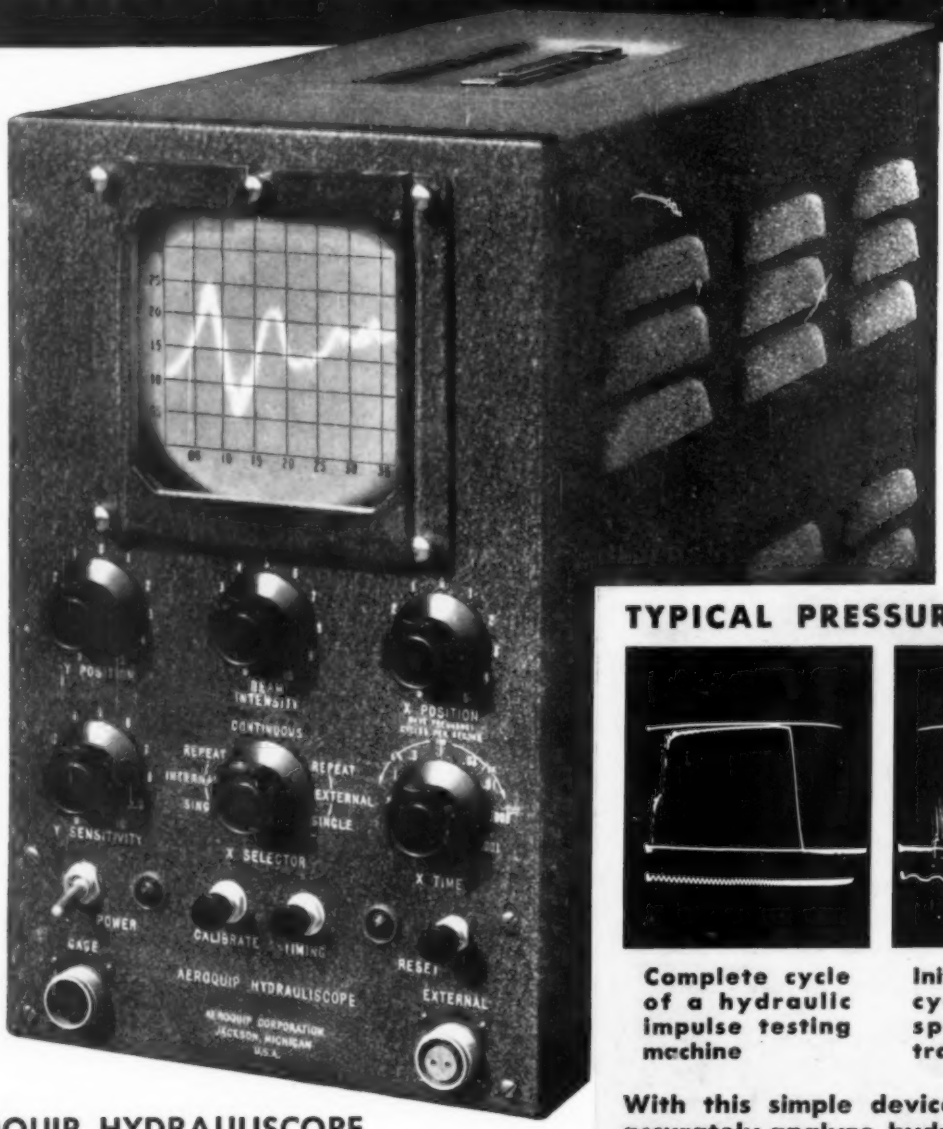
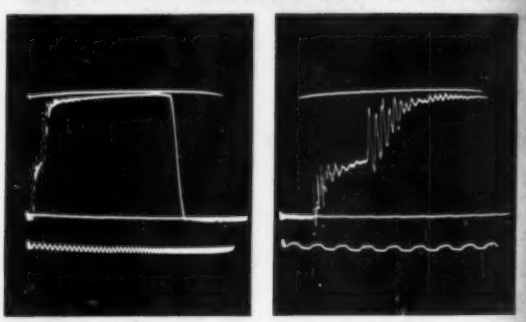


TYPICAL PRESSURE GRAPHS



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APRIL, 1949

Vol. 2 No. 3

Applied HYDRAULICS

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1240 Ontario Street
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Phone: Tower 1-0264
AT & T Teletypewriter Number is CV-233

NEW YORK OFFICE
STEPHEN SHEPARD
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Subscriptions

By the year	$3.00
Two years	$5.00
Three years	$6.50
Single copy	25 cents
Canada	$4.00
Two years	$6.00
Foreign	$5.00

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FRONT COVER: Hydraulic equipment, new to the canning industry, eliminated a bottleneck and increased production 20 to 30 percent. The story begins on page 20.

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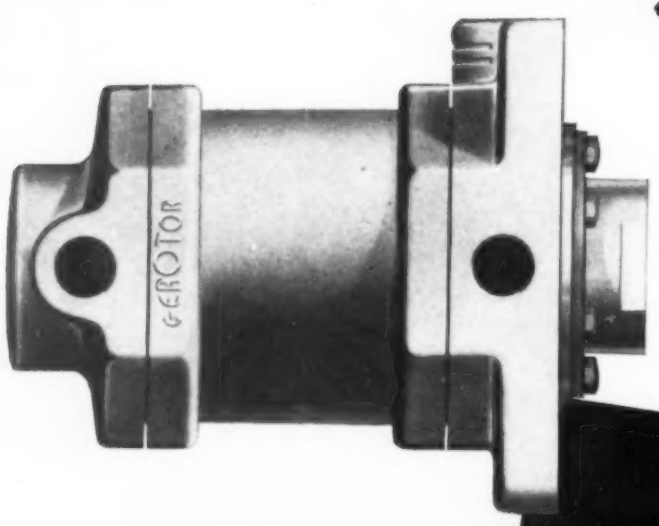
Applied Hydraulics is indexed regularly by Engineering Index, Inc.

All communications should be addressed to APPLIED HYDRAULICS
1240 Ontario Street, Cleveland 13, Ohio



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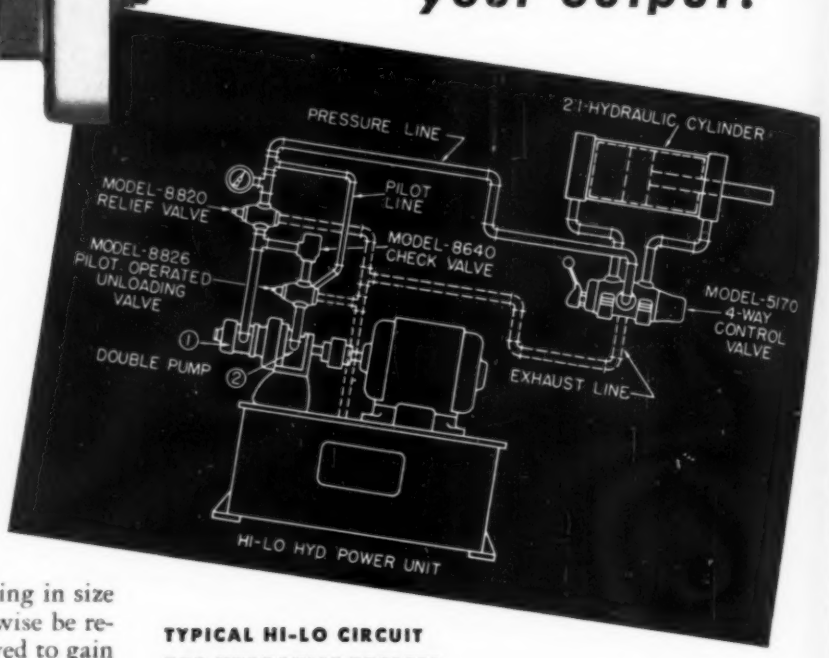

TYPICAL HI-LO CIRCUIT FOR HYDRAULIC PRESSES

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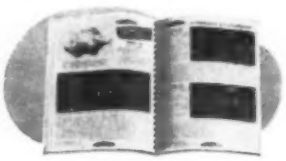

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But let's do more than that, for heaven's sake! Let's APPRECIATE what we have. Let's keep our freedoms shining . . . not wait till we have to fight to get them back!

PUTTING HYDRAULIC MOTORS TO WORK

By GEORGE I. CHINN
Baltimore, Maryland

The hydraulic motor, because of its high starting torque and low inertia of rotating parts, ability to change speed and direction of rotation rapidly, its compact size and explosion-proof construction and adaptability to operation from a remote power source and by remote control, makes it particularly desirable in many applications. Two typical applications are described and the method of determining sizes of motors and their driving pumps is given.

THE TRANSMISSION of power hydraulically in a straight line path is a phenomenon which has been known and accepted since Joseph Brahmah, by his invention of the cup packing in 1785, first put to effective use Pascal's fundamental principle of hydraulics. On the other hand, the method of transmitting power hydraulically in a rotary path, although it has been used for almost fifty years and was extensively used for military applications in the last war, seems rather mysterious to most people not actively engaged in industrial hydraulics. However, a moment's reflection will disclose that the same principles of pressure generation and fluid displacement apply for both rectilinear and rotary hydraulic power transmission.

The device used for rotary hydraulic motive power is now commonly called a hydraulic motor. The hydraulic motor is basically the same as a positive displacement pump, whether gear, vane or piston; it is characterized by the fact that a definite rotation angle of the shaft results from a given displacement of fluid, or, in other words, the speed of shaft rotation is substantially proportional to the volume of fluid passing through the motor.

Potential applications of the hydraulic motor offer a wide field of development. Certain inherent characteristics of its performance place it in a most advantageous position as compared with electric motors, internal combustion engines and mechanical drives. The hydraulic motor offers a means of producing high starting torque over a wide range of speeds and of obtaining infinite shaft speed variation by control of the fluid flow into its elements; the low inertia of its rotating parts compared with those of other rotary power devices permits very rapid change of speed and direction of rotation. It may be actuated from a remote power source and it may be controlled remotely. As a rule, the hy-

Fig. 1. The 4000 gallon tractor-trailer aviation refueler in use at the New York International Airport.

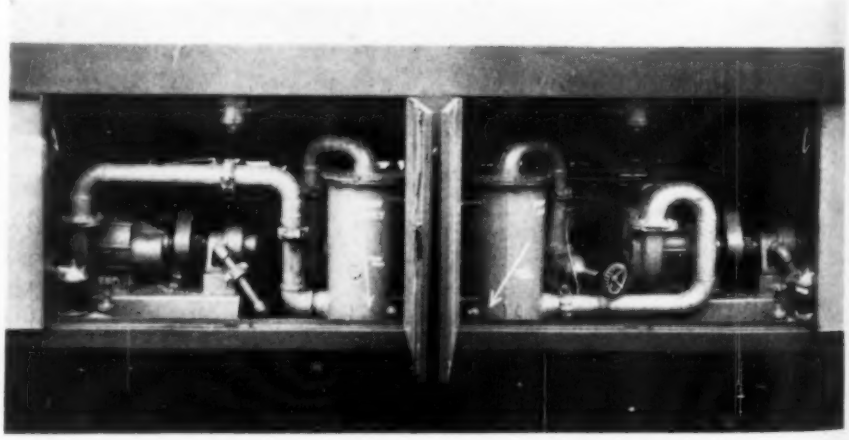

Fig. 2. The pump compartment of the refueler, showing the gasoline dispensing pumps and the hydraulic motors (extreme right and center of left panel).

Figures 1 and 2 are used by permission of the Shell Oil Co., Inc.

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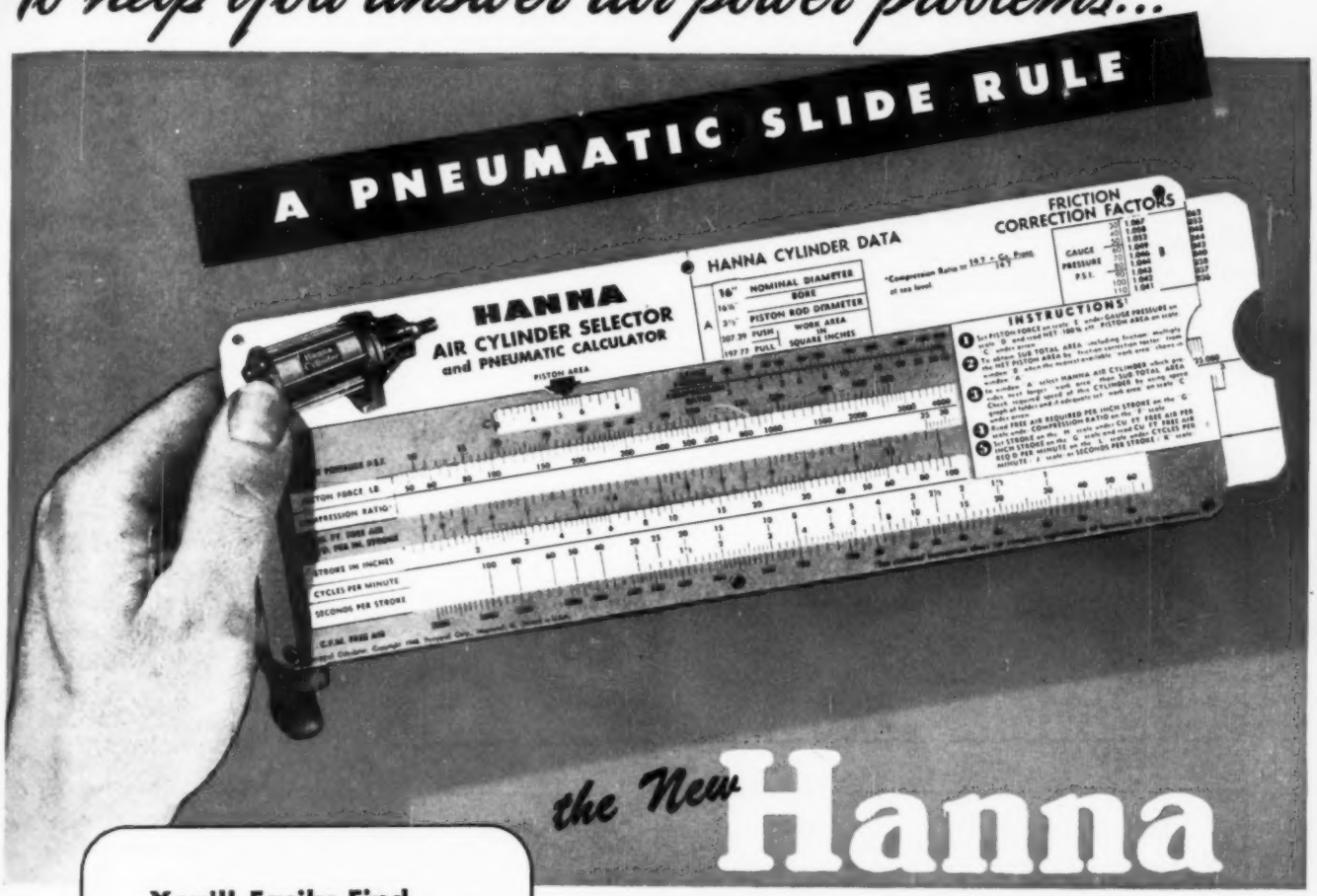

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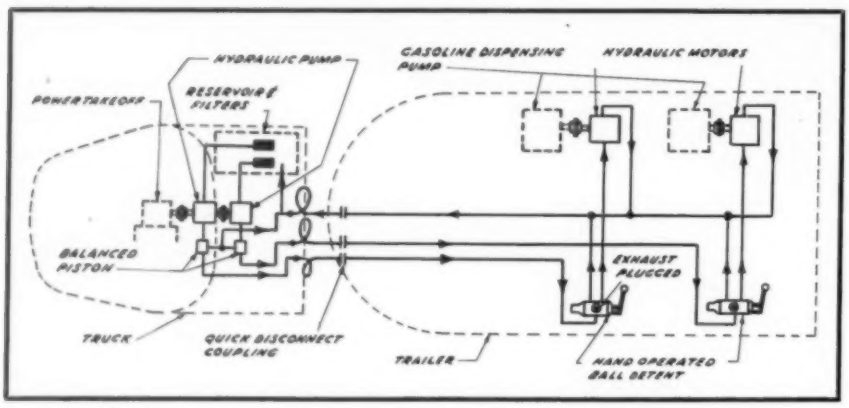
draulic motor is considerably smaller in size than an electric motor of comparable horsepower, permitting its use in small, confined spaces. It may be stopped in a stalled position for any length of time without injury to its parts; it is explosion-proof and may be operated in atmospheres which would be injurious to electric motors and mechanical drives with exposed vital components.

An application which illustrates the utilization of some of the advantageous characteristics of hydraulic motors is the 4,000 gallon tractor-trailer aviation refueler now in use by the Shell Oil Company at the New York International Airport, shown in Figures 1 and 2.

In this installation, the hydraulic circuit of which is shown in Figure 3, each of two hydraulic motors mounted on the trailer drives a 200 gpm centrifugal gasoline dispensing pump at a speed of 1750 rpm against a pressure of approximately 40 psi. Oil to drive the motors is supplied by two pumps mounted on the truck and driven through a power takeoff by the engine. The motors may be driven independently or simultaneously, as desired; their starting and stopping is effected by four-way, two-position valves, mounted on the trailer. The pumps unload to the reservoir when the motors are stopped. Quick disconnect couplings and flexible connections permit rapid and easy separation of the trailer from the truck. In this installation, the requirements that the drive be explosion-proof, compact and capable of remote actuation and control were successfully met.



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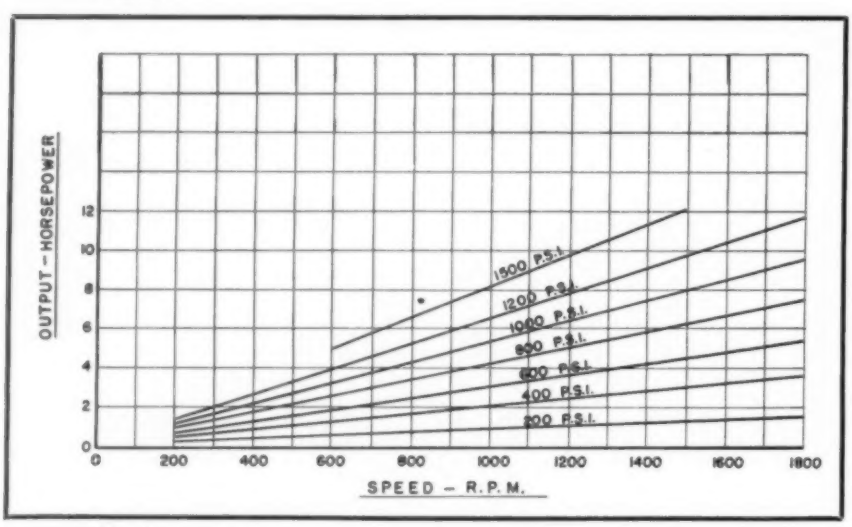

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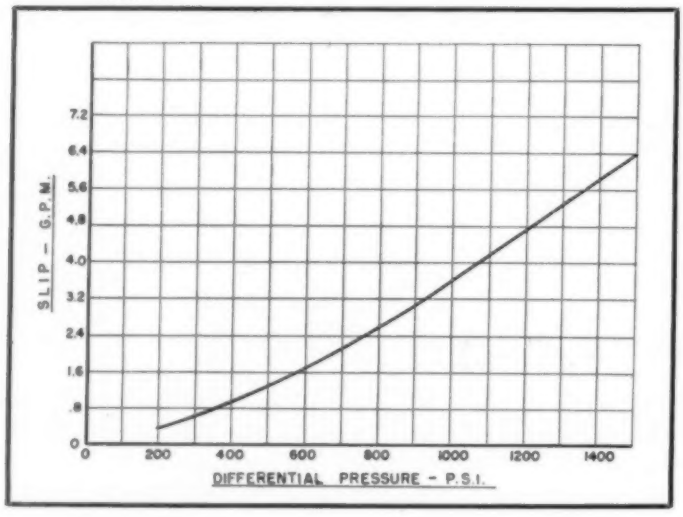

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Determining Pump and Motor Sizes

It may be of interest to the reader to know how the sizes of the motors and their driving pumps used in this installation were determined. The hydraulic horsepower output of each centrifugal pump, based on the well-known formula

HP = .000583 × Flow (in gpm) × Pressure (in psi)

was 4.66; estimating a 50 percent overall efficiency gives a required input horsepower of 9.32. From the characteristics chart, Figure 4, an operating pressure of 1000 psi to produce this power at 1750 rpm was determined. Since the displacement of the hydraulic motor is 2.55 cu in per revolution, the theoretical oil flow was

$$\frac{2.55 \times 1750}{231} = 25.5 \text{ gpm}$$

Fig. 3. Hydraulic circuit of the refueler.

Fig. 4. Output horsepower characteristics.

Fig. 5. Leakage characteristics.

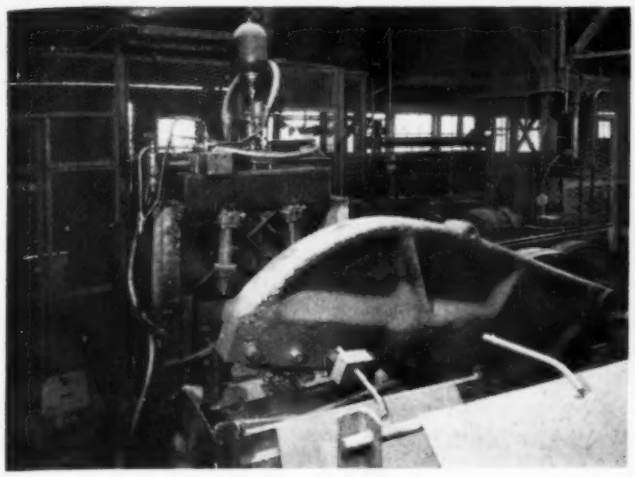


Fig. 6. Billet shear, showing arrangement of hydraulic hold-down cylinders.

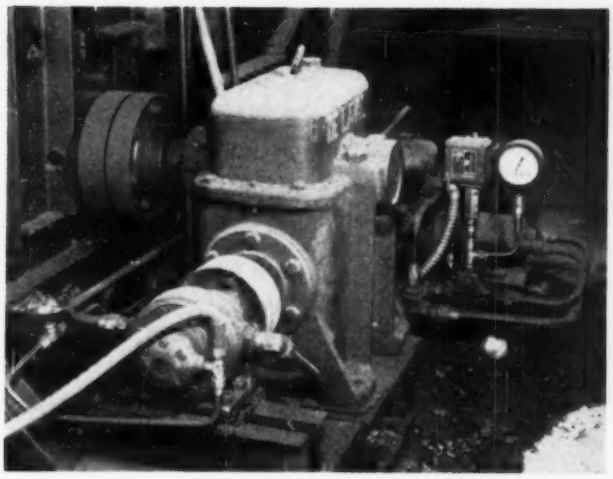


Fig. 7. The feed motor (front) and "takeaway" motor (right rear), the first operates intermittently, the other continuously, to drive the feed and "takeaway" belts respectively.

To this the slip or leakage must be added. The leakage characteristics of this same hydraulic motor are shown graphically in Figure 5. The leakage through the motor at 1000 psi is determined as 3.6 gpm. This gives a total of 29.1 gpm. To supply this quantity of oil, a 30 gpm pump was provided for each motor.

An application which strikingly illustrates the ability of the hydraulic motor to literally "stop on a dime", because of its low inertia, and to operate in a dusty and corrosive atmosphere is one which is used to shear billets of metal prior to their melting.

In this installation, shown in Figures 6 and 7, billets weighing approximately 150 pounds and varying in thickness from 1 to 6 inches, are fed to a mechanically actuated shear which operates at a rate of 26 strokes per minute. The shear operates in an atmosphere of metallic dust and fumes of zinc and ammonium chloride.

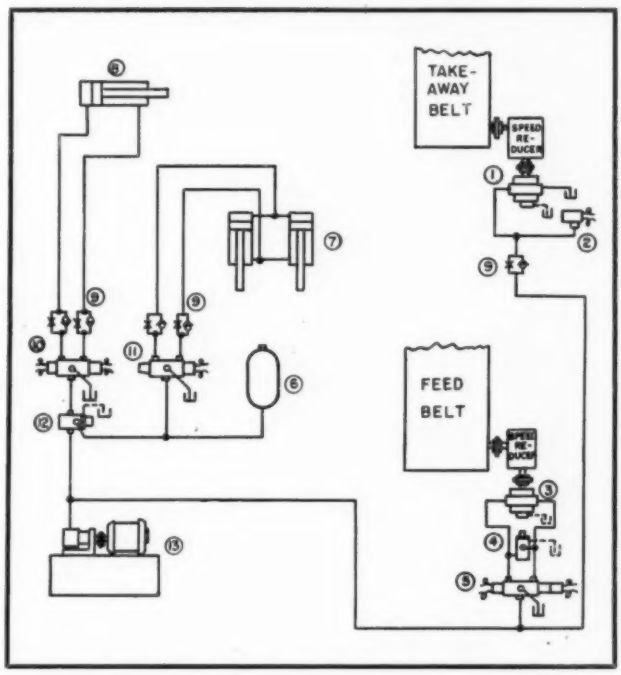


Fig. 8. Hydraulic circuit of billet shear.

Operation of Feeding and Takeaway Belts

Feeding is accomplished by a conveyor belt which receives the billets from a gravity conveyor and is driven by a hydraulic motor in adjustable steps, synchronized with the operation of the shear and hydraulic hold-down cylinders, the latter holding the slabs in position for shearing. The sheared metal is received by a "takeaway" belt, also driven by a hydraulic motor, which raises it up a 30 degree incline to one or the other of two gravity fed bins, the selection of which is determined by control of a hydraulically operated gate.

The sequence of hydraulic operation of the installation may be followed by reference to Figure 8. The shear has a stroke of 11 in and at 4 in from its open position the moving head actuates a limit switch to start an adjustable timer, which controls the spring centered, four-way double solenoid valve 5 and determines the time interval during which oil is permitted to flow through the end belt hydraulic motor 3, thereby governing the distance traversed by the belt. At the end of this interval, a maximum of .8 second, solenoid valve 5 is de-energized by the timer, blocking both ports of the motor and causing it to stop almost instantaneously. This means that the motor starts, comes up to its maximum speed of 800 rpm and then stops, all in .8 second. Dangerous pressures in the motor discharge line, which would be

(Continued on page 22)

HYDRAULIC PACKING

Part 2 of this survey covers the construction and application factors of typical mechanical seals. An appreciation of the design factors involved and their early integration with the design of equipment on which seals are to be used saves time, eliminates costly redesign and simplifies the application problem.

AS MECHANICAL DEVELOPMENT progressed and systems employing hydraulic actuation grew in popularity, a more practical and fool-proof means of sealing glands was demanded. Designers clamored for a means of sealing glands, that once installed, would not be dependent on the human element.

The mechanical seal can only be applied to rotating shafts. Figure 9 shows a typical mechanical seal, basically a rotating and stationary element and some means for keeping them in contact. If the seal is to give the maximum in satisfactory, efficient service and life, there are some important construction factors involved. The factors are:

(1) Flexibility
(2) Surface finish of the mating faces
(3) Positive driving means
(4) Metallurgy
(5) Engineering, laboratory testing and research.

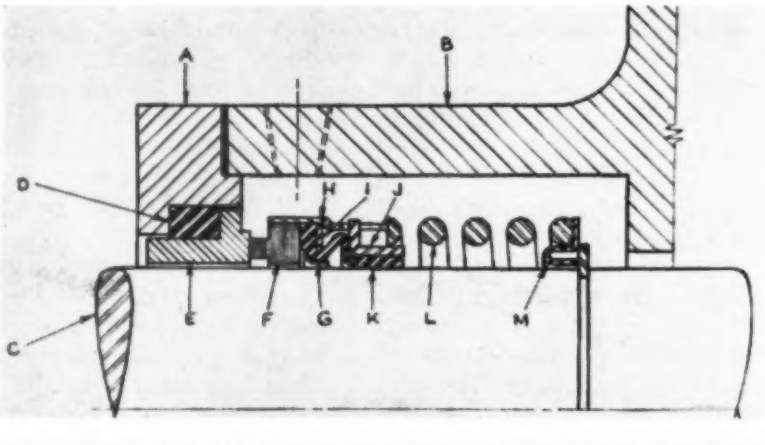
Because very little has been published on the mechanical seal and the factors which determine its success or failure, these will be discussed in turn.

Flexibility. The seal, like the mechanical device to which it is applied, must have manufacturing tolerances. Flexibility is, therefore, important. Axial tolerances below plus or minus .005 cannot be held, even in precision equipment. In high production equipment this tolerance may range as high as plus or minus .020. When initially installed, a good mechanical seal must be able to compensate for this axial tolerance plus the overall length tolerances of the seal, which on high production items is practically never closer than plus or minus .015. Thus, it is not unusual to have to meet a total axial tolerance of .035.

Figure 10 shows graphically the necessity for and effect of flexibility.

Shaft vibration and radial tolerance is another factor. It frequently ranges from plus or minus .002 to as high as plus

Fig. 9. A typical mechanical seal applied to a conventional stuffing box or other mechanical drive.



NOMENCLATURE OF PARTS:

(a) Gland plate or cover
(b) Stuffing box
(c) Shaft
(d) Floating Seat Ring
(e) Floating Seat
(f) Sealing washer
(g) Shaft protecting ferrule
(h) Retainer shell
(i) Bellows flange retainer
(j) Driving band
(k) Synthetic rubber bellows
(l) Spring
(m) Spring retainer

AND SEALS

By CARL E. SCHMITZ

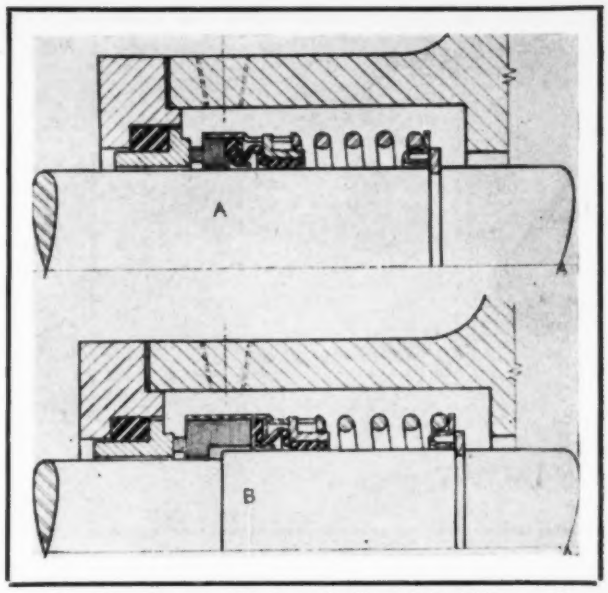


Fig. 10. The necessity for and effect of flexibility are shown graphically. View "A" shows the mechanical seal in position for use; view "B" shows the axial movement desirable in good mechanical seal construction.

or minus .005. Since wear will vary under varying conditions of service, provision for not less than .090 wear should be made to insure the maximum of life. When that much wear occurs the seal should be replaced.

Springs are usually employed to keep the seal faces in contact as required for axial or initial tolerance and subsequent wear. Since high loading results in heating and excessive wear of the seal faces, the flexing members must be designed so that proper movement under installation and operating conditions is assured at low pressure. Materials that will not "work harden" or crystallize, common with thin metallic structures, must be used.

Specially compounded synthetic rubbers provide about the best flexing members. A flexing member must withstand considerable axial movement with the least possible effort. In addition, the components of a good seal must be designed to permit the flexing member to move radially and axially, freely and under all operating conditions.

Floating seats are rapidly replacing the so-called solid end plates, since the seat, floating as it does in a synthetic resilient ring, imposes no detrimental stresses beyond the flatness required and permits ready replacement at economical cost. Such seats are easily adaptable to most mechanical and hydraulic devices.

Surface finish of the mating faces. Seal faces, usually set in a vertical plane, present a somewhat more difficult problem than ordinary bearings. Before lapping and highly polished and parallel surfaces were commercially feasible, seal manufacturers actually shipped containers of abrasives and gave instructions to use the abrasive paste between the faces to wear them in. They neglected to give instructions on how to remove the abrasive paste or to explain the effect on the oil or product handled. Modern high surface finishes have eliminated the "break-in" period and permit more efficient and effective lubrication by developing conditions that eliminate oil film failure.

Technique of handling and conditioning of lapping fluids—stress relieving and product handling were worked out to make the process adaptable to high speed production requirements. There are two main objectives in the production of a good mating or bearing surface: (1) the metallurgical, or the removal of defective metal at the surface produced by the shaping or dimensioning operations and expose the true crystals of the materials actually bisected and achieve an extremely fine plane surface; and (2) geometrical, the removal of the hills and valleys (scratches and flaws) to generate a true and smooth surface which will eliminate the danger of film rupture and material-to-material contact.

Surface finishes have developed under both scientific and engineering research; equipment to evaluate surface conditions is being improved and being made available to industry. For example, the progressive manufacturer inspects all lapped surfaces with optical flats—spot checks will not suffice.

Positive driving means. It is important that a means be provided for driving the seal so that none of the torque load can be or is imposed on the flexing member. The washer or moving face may require considerable break-out torque; if the flexing member is called upon to carry any part of this load or the running load, it soon crystallizes, especially if the membrane is metallic. If it is of synthetic rubber, internal abrasion and constant flexing causes the material to break down rapidly, causing seal failure.

Good practice requires that the flexing member must be constructed to permit close contact of the faces to compensate for wear. High psi loading tends to exclude the thin lubri-

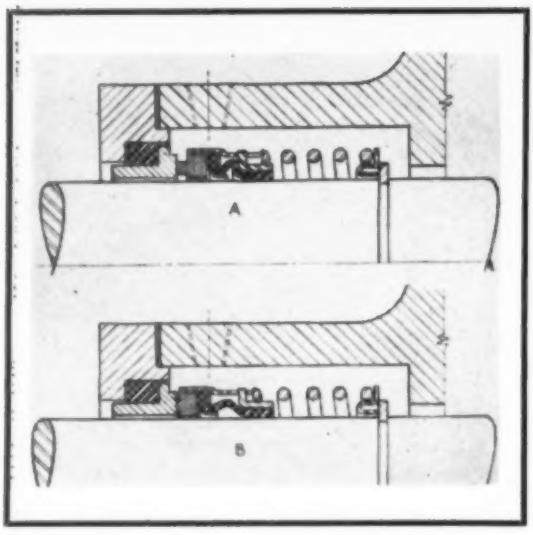


Fig. 11. Illustrates the difference between standard and balanced seal construction. View "A" is that of a standard seal assembly; view "B" is that of a balanced seal assembly.

cating film. Attempts to use high spring pressure, imposing the driving torque load on the spring frequently results in chattering, poor seal life and general dissatisfaction.

Metallurgy. Good general metallurgy requires the selection of proper materials to withstand the medium in which the seal operates. This problem is not too severe in most hydraulic equipment since steel or brass, the most commonly used, serve well in oil, water, greases and hydrocarbon distillates. However, seals are finding steadily increasing use in the highly complex chemical industries where corrosion is a common problem. Stainless steel, usually of the 316 variety, is frequently used in these instances.

Washer and seat material combinations are of the highest importance in seal metallurgy; for most hydraulic applications a good grade of cast iron with carbon or synthetic resin bonded graphite and metal combinations make for long, satisfactory life. Such combinations are well suited for relatively high speed hydraulic applications where the principal problem is holding a lubricating medium. Stellite faced floating seats can be used to advantage under extremely high pressure conditions. Hardened steel seats with various combinations of leaded bronzes do well, although experience has shown that the heat generated at the seal faces is considerably higher in the metal-to-metal combinations than in the carbon-to-metal combinations.

Engineering—laboratory testing—and reseach. A seal is only as good as the engineering, testing and research that goes into it. For example, engineering involves structural designs as well as applications. Take the problem of mating face widths. Starting with what seems theoretically practical, various combinations of wider and narrower faces are tested. By cut-and-try the most desirable is selected for operation in a given material at selected speed, temperature and pressure.

Testing should not be confined to any single type of equipment. A good variety of pumps and mechanical appliances should be available so that tests can be conducted over a wide range of services.

The engineering organization should include specialists in application principles as well as design and development specialists. A research laboratory can support the work of the engineering department and mechanical testing laboratory by analyzing various materials to be handled and in assisting in the selection of construction materials best suited for any given problem.

Speed. Tests conducted to date seem to indicate that about 12000 rpm or 5000 fpm, whichever is the lower, is the approximate maximum speed that can be tolerated.

The problem of excessive speed is not generally encountered in centrifugal pumps where speeds of 3600 to 4000 rpm are general. Speeds in positive displacement pumps rarely exceed 1200 rpm. In such applications as centrifugal blowers, which operate at shaft speeds from 6000 to 9000 rpm, the seal designer has a real problem due to the large shaft sizes normally involved.

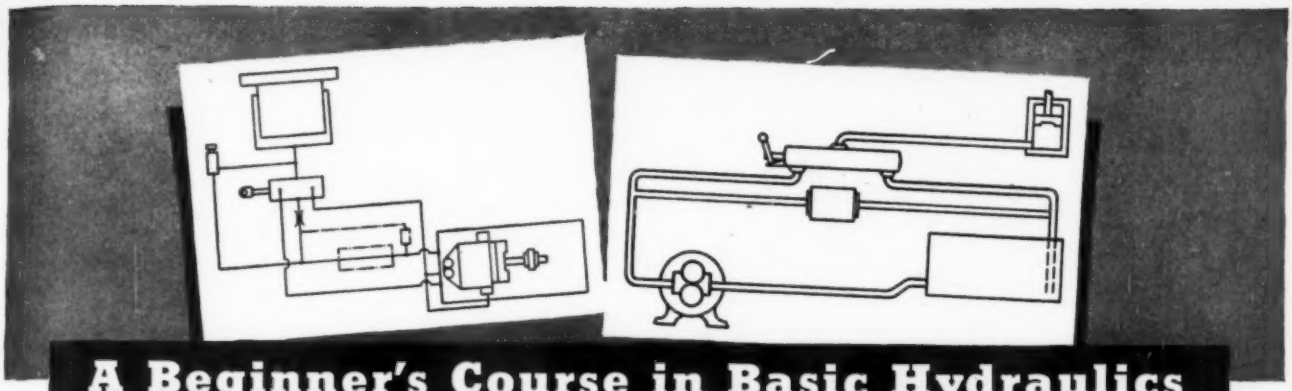
Spring behavior must be studied when considering speed limits since experience has shown that springs behave rather unxepectedly under the influence of centrifugal force.

Dry running. So-called dry running must be avoided in mechanical seal usage since the materials used for seat and washer tend to distort or abrade at temperatures over 400 F. Provision must be made to insure liquid in the seal chamber at all times. In the case of pumps, this can usually be done by providing a line from the pump discharge to the seal chamber. In mechanisms other than pumps, the liquid sealed can usually be brought in constant contact with the seal faces.

Pressure. The properly designed mechanical seal can be used for a wide range of pressure conditions. Standard seals can be used for vacuum service down to .5 mm of Hg absolute and on pressures up to 200 psi gauge without difficulty and covering any liquid in which a seal can be operated. When pressures of over 200 psi gauge are encountered in the seal chamber, balanced seal construction is recommended. See Figure 11.

The balanced seal is constructed so that the seat and washer faces are in pressure balance. Complete balance is not advocated. Balancing out to within ten to fifteen percent is suggested, to prevent poppet

(Continued on page 24)



A Beginner's Course in Basic Hydraulics

Part 2. Introduction

In this second installment pressures and forces in hydraulic systems and hydraulic jacks and brakes are discussed. There are no mysteries in hydraulics; an understanding of the principles involved clears the way for sound progress in recognizing and making efficient applications.

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Pressure and Force in Hydraulic Systems

Application and transmission of forces. We have seen that, in accordance with Pascal's Law, any force applied to a confined liquid is transmitted equally in all directions throughout the liquid regardless of the shape of the container. Let us now consider the effect of this in a system, as shown in Figure 8. This is in reality a modification of Figure 4, in which the column of liquid is curved back upward to its original level, with a second piston at this point. It is clear that if we push down on piston 1, a pressure will be created throughout the liquid, which will act equally at right angles to surfaces in all parts of the container.

Pressure is defined as force divided by the area over which it is distributed. In the case of Figure 8, force 1 is 100 pounds and the area of the piston is 10 square inches, therefore the pressure in the liquid must be 10 pounds per square inch. This is usually written 10 psi.

This pressure must act also on piston 2, so that for every square inch of its area it will be pushed upward with a force of 10 pounds. In this case we are considering a liquid column of uniform cross section, so that the area of piston 2 is the same as piston 1 or 10 square inches. Therefore, the upward force 2 on piston 2 will be 100 pounds, the same as was applied to piston 1. All we have done in this case is to carry our 100 pound force around a bend. The principle illustrated underlies practically all mechanical applications of hydraulics.

Fig. 8. A hydraulic system of uniform pipe cross section, the force being carried around two bends.

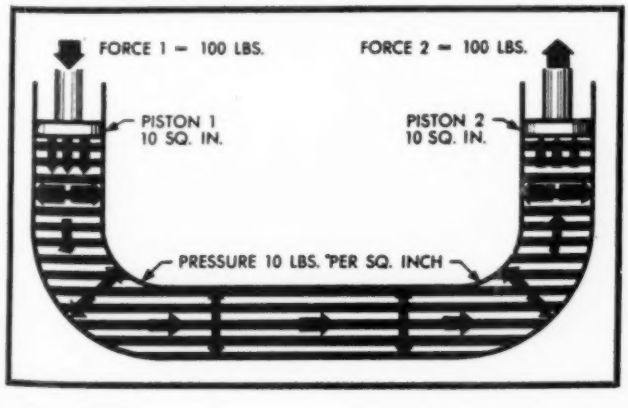
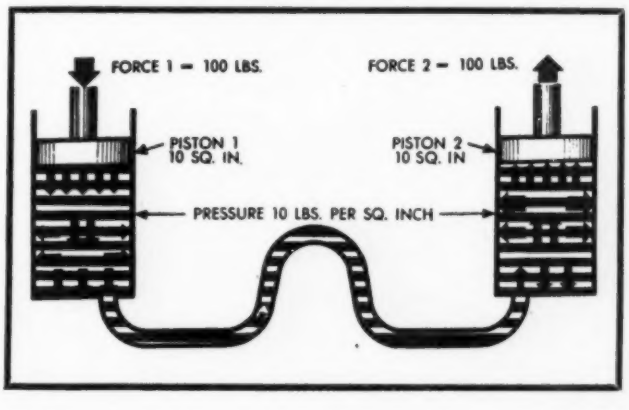


Fig. 9. A force is shown being carried through a tube of less area than the piston areas.



It should be noted that, since Pascal's Law is independent of the shape of the container, it is not necessary that the tube connecting the two pistons be the full area of the pistons throughout. A connection of any size, shape or length would do, so long as an unobstructed passage is provided. For this reason the system shown in Figure 9, wherein a relatively small bent pipe connects two cylinders, would act exactly the same as that shown in Figure 8.

Multiplication of forces. In Figures 8 and 9 we considered hydraulic systems with pistons of equal area and in which the output force was equal to the input force. Let us now consider the situation of Figure 10, where the input piston is much smaller and the output piston much larger. Let us assume that the area of piston 1 is now 2 square inches and that of piston 2 is 20 square inches. Now, if we push down on piston 1 with a force of 20 pounds, the pressure created in the liquid will again be 10 psi, although the original force is much smaller.

As we have seen, this pressure of 10 psi will act on all parts of the liquid container, including the bottom of piston 2. The upward force on piston 2 will therefore be 10 pounds for each of its 20 square inches of area or 200 pounds. In this case we have multiplied our original force tenfold while using the same pressure in the liquid as before. Obviously, the system would work just the same for any other forces and pressures, so that the ratio of output force to input force would always be ten to one.

The system will, of course, work the same in reverse. If we consider 2 the input piston and 1 the output piston, the output force would always be one-tenth the input force. Sometimes we wish to secure just such a result.

We can now state the general rule that, because of Pascal's Law, if two pistons are used in a hydraulic system, *the force acting on each will be directly proportional to its area, and the magnitude of each force will be the product of the pressure and its area.*

Differential areas on a piston. Let us now consider the special situation shown in Figure 11. Here we have a single piston in a cylinder 2 with a piston rod 3 attached to one side of the piston and extending out of the cylinder at one end. Liquid under pressure is admitted to both ends of the cylinder equally through the pipes 4, 5 and 6. The opposed faces of piston 1 behave like two pistons acting against each other. The area of one face is the full area of the cylinder, say, for example, 6 square inches, while the area of the other face is the area of the cylinder minus the area of the piston rod, which is 2 square inches. This leaves an effective area of 4 square inches on the right face of the piston. The pressure on both faces will, of course, be the same, say, for example 20 psi. Applying the rule just stated, we find that the force pushing the piston to the right will be its area times the pressure, $20 \times 6 = 120$ pounds. The force pushing the piston to the left will be its area times the pressure, or 80 pounds. Therefore, there is a net unbalanced force of 40 pounds acting to the right, and the piston will move in that direction. The net effect is the same as if the piston and cylinder were just the size of the piston rod, since all other forces are in balance.

Volume and distance factors. In the systems of Figures 8 and 9 the pistons had areas of 10 square inches each. Therefore, if we pushed one of them down one inch, 10 cubic inches of liquid would be displaced. Since the liquid is practically incompressible, this volume of liquid must go some place. The only thing for it to do is to move the other piston. Since the area of this piston is also 10 square inches, it will have to move one

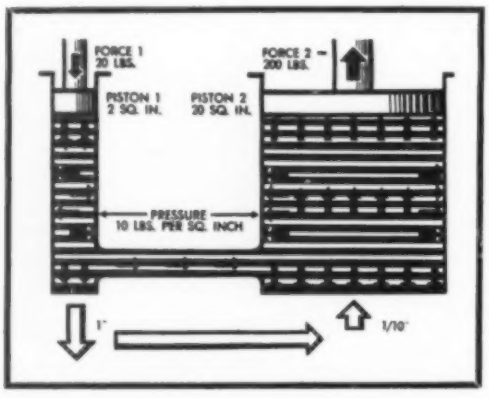


Fig. 10. Because a force acting on two pistons will be directly proportional to their areas, an input force can be multiplied by the area relation, here shown at 10 to 1.

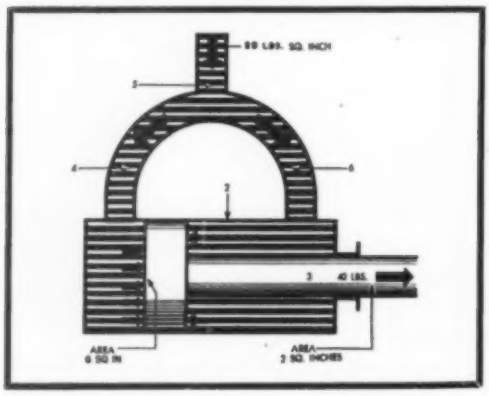
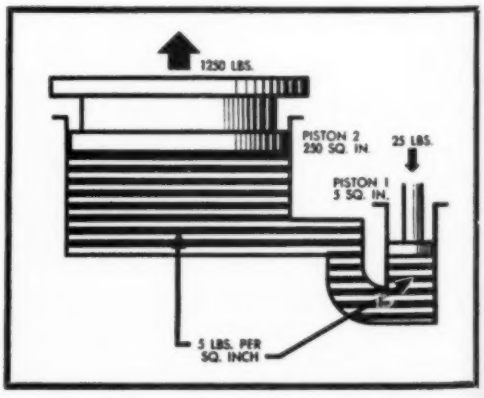


Fig. 11. With the same pressure on both faces of a piston, the differential area causes the piston to move. Here it would move to the right.

Fig. 12. The basic action of a hydraulic jack. For a given displacement the distances moved are inversely proportional to the piston areas.



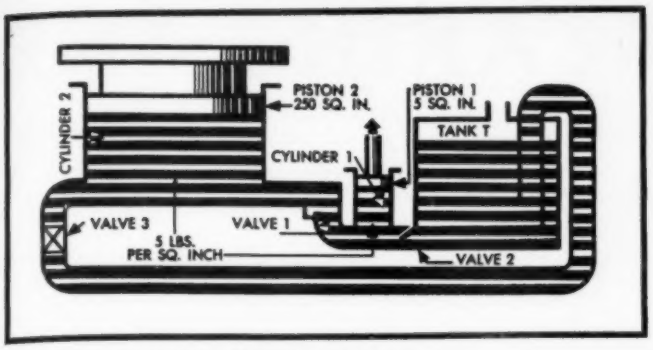


Fig. 13. A complete hydraulic jack circuit with the input piston raised. Valve 1 to cylinder 2 is closed, valve 2 from tank is open.

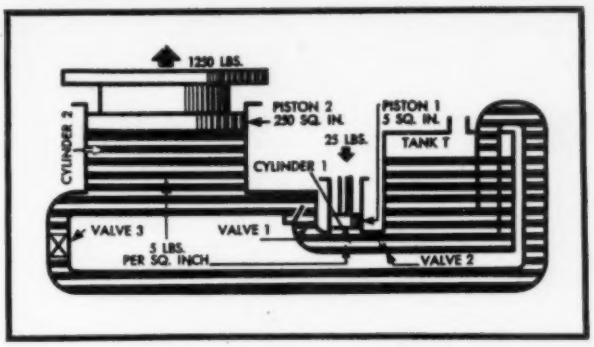


Fig. 14. The same circuit shown in Fig. 13 with input piston lowered. Valve 1 is open discharging fluid to cylinder 2, valve 2 is closed. The jack is lowered or retracted by opening valve 3, discharging fluid to tank.

inch in order to accommodate the 10 cubic inches of liquid. The pistons are of equal areas, and will therefore move equal distances, though in opposite directions.

Applying this reasoning to the system of Figure 10, we find that if piston 1 is pushed down one inch only 2 cubic inches of liquid will be displaced. In order to accommodate these 2 cubic inches of liquid, piston 2 will have to move only 1/10 of an inch, because its area is 10 times that of piston 1. This leads to the second basic rule for two pistons in the same hydraulic system, which is that *the distances moved are inversely proportional to their areas.*

Hydraulic Jacks and Brakes

General Set-up for Hydraulic Jacks. Suppose we need to lift heavy weights, and that only a small force—for example hand power—is available for the purpose. The use of a hydraulic jack will solve the problem.

In Figure 12 the small piston has an area of 5 square inches. The small cylinder is directly connected to a large cylinder with a piston having an area of 250 square inches. The top of this piston forms a lift platform.

Now, if a force of 25 pounds is applied to the small piston, it produces a pressure of 5 psi in the liquid. This pressure acting on the 250 square inch area of the output piston will make a force of 1250 pounds available to raise the lift. An input force of 25 pounds has been transformed into a working force of more than half a ton.

With respect to distances travelled, however, the story is the exact opposite. Lowering the small piston 5 inches will displace 25 cubic inches of liquid, and this distributed over the 250 square inch area of the large cylinder will raise its piston only $25/250 = 1/10$ inch.

Practical Problems. We have managed to raise 1250 pounds 1/10 inch. It is most unlikely that anyone would ever want to stop at this. Unless the weight can be raised to a greater height, in most cases no practical result will be achieved. Our machine as it stands is not even fitted to maintain the advantage it has gained. If the force on piston 1 is released, the lift piston will drop back to its original position, and conditions will stand as they were at the beginning.

We must do something to hold the lift platform in place at the new level, after it has been raised, and we must provide some means of repeatedly raising and lowering piston 1, gaining 1/10 inch at each double stroke. We must also find some way of lowering the lift platform to any desired level. Then we shall have a hydraulic jack capable of raising 1250 pounds a considerable distance by hand, although at the rate of only 1/10 inch per stroke.

These results are attained by introducing a number of valves and a reserve supply of liquid to be used in the system (Figures 13 and 14). As the input piston, Figure 13, is raised, valve 1 will be closed by the back pressure from the weight on piston 2, but valve 2 will be opened by the head of liquid in reserve tank T. This will force liquid into cylinder 1. When piston 1 is lowered, Figure 14, a pressure will be developed in cylinder 1. When this exceeds the head in tank T, it will close valve 2 and when it exceeds the back pressure from piston 2 it will open valve 1, forcing liquid into the pipe line. The pressure

(Continued on page 24)

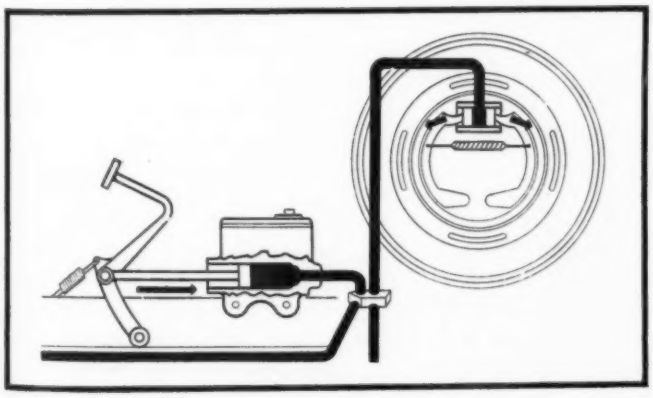


Fig. 15. A schematic view of the master cylinder and one pair of output pistons in a typical automotive hydraulic brake system.

BREAKING THE FINAP

By BENJAMIN W. SMITH
Divisional Plant Engineer
The Quaker Oats Company

In the canning industry the operation of transferring cans from closing machine to the retort basket defied, until recently, efforts made to eliminate this serious handicap to production. A completely automatic, hydraulically actuated loader has ended this bottleneck — flexibility of handling all types of containers has been increased; operator fatigue has been lightened; and production has been stepped up 20 to 30 percent.

Fig. 1. The old method of handling cans was slow, clumsy and hard work. This one hand operation slowed down the whole production line.

ONE OF THE WORST bottlenecks to plague production men in the food processing industry — the transfer of cans from the closing machines to the retort basket—has finally been broken.

It has been broken by a simple but highly ingenious application of hydraulic equipment to the can handling job, a method designed and pioneered by the Process Equipment Division of the W. F. & John Barnes Company of Rockford, Illinois.

In case you are not strictly up to date on canning procedure, Figure 1 shows the old method of transferring cans from the closing machine to the retort basket, a method still in use by ninety-five percent of the industry.

It is an awkward, clumsy, manual method — and pitifully slow in comparison with the lightning-fast speed of all other operations along the production line. It is a hard, back-breaking job for labor; it is frequently a near-impossible task to find sufficient help to keep production lines moving. It is an aggravating slowdown that cuts deeply into the efficiency of other expensive equipment, since a slowdown in one spot on a production line is a slowdown in all spots.

Figure 2 shows the same position on the production line after the installation of the new hydraulic method. The upsurge of productions runs as high as 20 to 30 percent; at the same time it materially eases the labor problem.

Here we see a Barnes Junior Loader and Infeed Conveyor handling the production of two closing lines, each running 160 No. 300 size cans per minute. One operator easily controls this flood of production, loading a basket with four layers of 110 cans each, a total of 440 cans, in the amazingly short time of 72 seconds.

While we are still looking at Figure 2, let's actually follow the progress of the cans. As they leave the two inspection tables at the end of the closing lines, they drop into the infeed conveyor. Figure 3 shows a close-up view of this part of the operation. The cans are carried in a double line, one from each closing machine, toward the loader; at the end of the infeed conveyor the cans are converged into a single line by means of a rotary disc.

Without a break in their forward flow, the cans pass a star wheel equipped with a counting device on to the revolving collecting disc. In the meantime,

PRODUCTION BOTTLENECK

Fig. 2. A general view of the revamped production line with hydraulic loader in operation. The machine keeps ahead of two closing lines, each running 160 No. 300 size cans per minute.

the operator has positioned a retort basket in exact loading position and pressed the cycle starting button which sets the loader into completely automatic operation.

The hydro-electric magnet, which, with its mounting saddle weighs over half a ton, swings into position over the collecting disc. When the counting device has checked the full load of cans that the collecting disc can handle, it automatically stops the star wheel. This breaks the flow of cans long enough for the magnet to descend and pick up the load on the collecting disc.

As the magnet rises with its load, the star wheel is released to allow the flow of cans to continue. The magnet, in the meantime, swings through a short arc into loading position over the basket, and descends to deposit a layer of cans. It then rises and swings back into the pickup position over the collecting disc, ready to convey the next layer of cans.

When the fourth layer of cans is deposited in the basket, the operator pushes the filled basket on to the conveyor leading to the retorts, and positions an empty basket for the next trip of the magnet. Sufficient time elapses between the swing of the magnet to pickup position and its return to loading position to allow for the exchange of baskets without halting production.

Incidentally, it will be noted that there is a large storage table built into the infeed conveyor. This allows the flow from the closing machines to continue without a break, even though the loader should be stopped momentarily while the operator

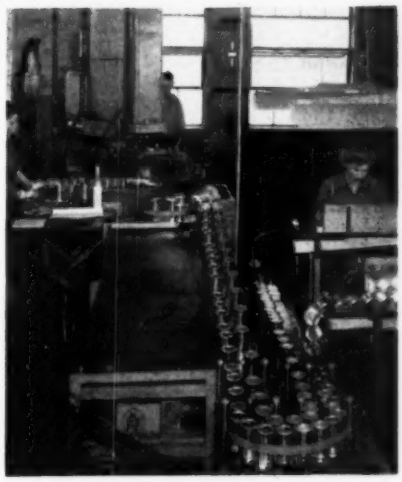


Fig. 3. A close-up of the infeed conveyor between the inspection stations and the revolving collecting disc.

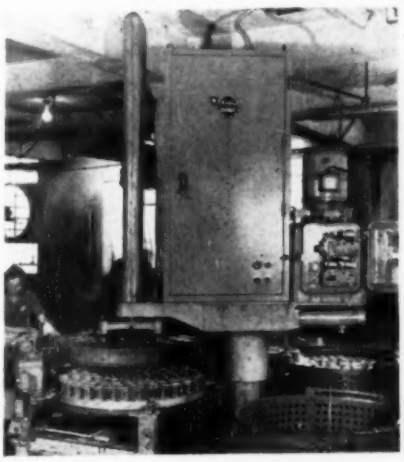
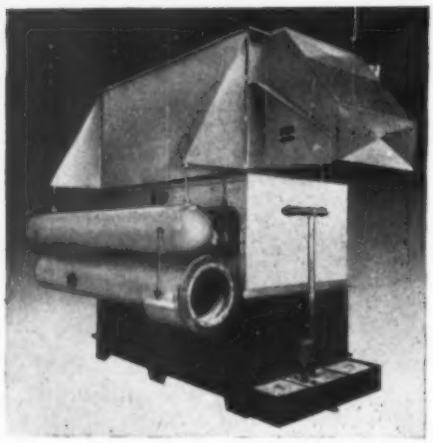


Fig. 4. The hydro-electric magnet is about to pick up a unit of 110 cans which will be lifted, turned and deposited in the waiting retort basket. The valve panel cover is shown open.



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waits for an empty basket to reach him. The loader is enough faster than the closing lines to absorb any such occasional storage within a very few minutes.

The loader, which is the heart of this new method of can handling, is operated entirely by hydraulic power. Figure 4 shows the compact hydraulic unit with the valve panel cover open, as well as the hydraulic actuators.

The loader is extremely flexible in operation. This is due in large part to its utilization of hydraulic power. The travel of the magnet can be so finely adjusted that any glass container with metal cap is handled so gently that breakage is practically eliminated.

To make the cycle of can handling equipment complete, the same organization has perfected a basket unloader, which may be summarized briefly as a complete reversal of the loading process just described.

Three other important flexibility features are: (1) the loader can be adjusted within a few minutes to accommodate virtually any desired standard size container, whether of metal or glass, and the counter set for the proper number of cans per layer; (2) various shaped baskets can be loaded by changing the shape of the magnet to conform; and (3) odd-shaped containers can be handled by the utilization of special equipment.

We have entirely removed the former production bottleneck by the use of the hydraulic loader and by relatively simple changes in the conveyor system. The equipment has increased production 20 to 30 percent, lightened operator fatigue and increased the flexibility of handling both standard and special shaped containers. To us the hydraulic equipment is a big step forward in leveling out an increased production and in lowering costs.

HYDRAULIC MOTORS

(Continued from page 13)

generated by the tendency of the belt to overdrive, are prevented by the sequence valve 4, connected across the motor inlet and discharge lines.

Sufficiently before the shear contacts the billet, another limit switch, actuated by the moving head, energizes spring return four-way single solenoid valve 11 to operate the hold-down cylinders 7. After the slabs are sheared and the shear clears them, the hold-down cylinders retract and the hydraulic motor again starts and advances the feed belt. This process is repeated 26 times a minute. An accumulator 6, charged while the feed motor is at rest, assures rapid operation of the hold-down cylinders.

The hydraulic motor 1, driving the "takeaway" belt, operates continuously. Its speed is controlled by an adjustable orifice flow control valve 9; if the belt becomes undesirably loaded by jamming or dragging of the rough, sheared metal on the sides of the conveyor, the orifice downstream pressure rises to actuate pressure switch 2, deenergizing four-way solenoid valve 5 to stop the feed motor 3 until the load on the "takeaway" belt has dropped. A double solenoid four-way valve 10, push-button actuated, controls cylinder 8 which operates the chute selection gate.

It must not be assumed that the use of the hydraulic motor, because of its many advantages, is indicated for all rotary power applications. Where only constant speed is required and where minimum power consumption is of paramount importance, other motive devices should be used; provided, of course, the other hydraulic motor characteristics enumerated previously are not required. The reason for this is that the use of a hydraulic motor involves a double conversion of energy, i.e., from electrical to mechanical to hydraulic and from hydraulic to mechanical, and energy losses occur at each stage.

The author wishes to express his appreciation for the assistance of Mr. Thomas Paris of the Battersby Company in the preparation of this article.

Meeting Your Hydraulic or Pneumatic Power and Speed Control Requirements

CHECK VALVES

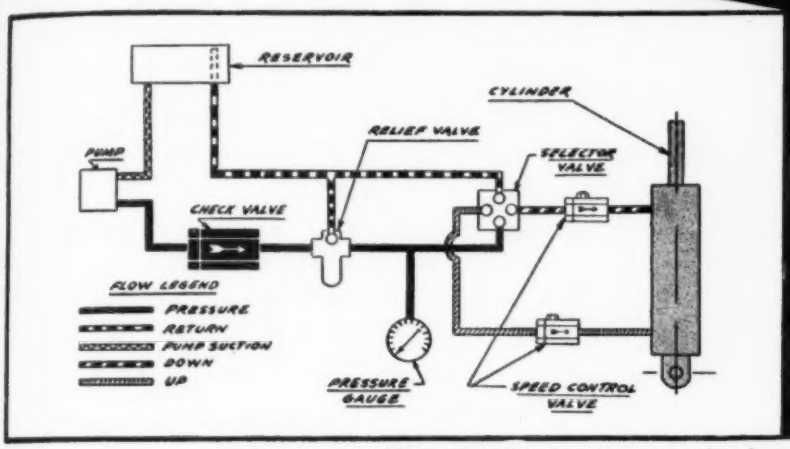
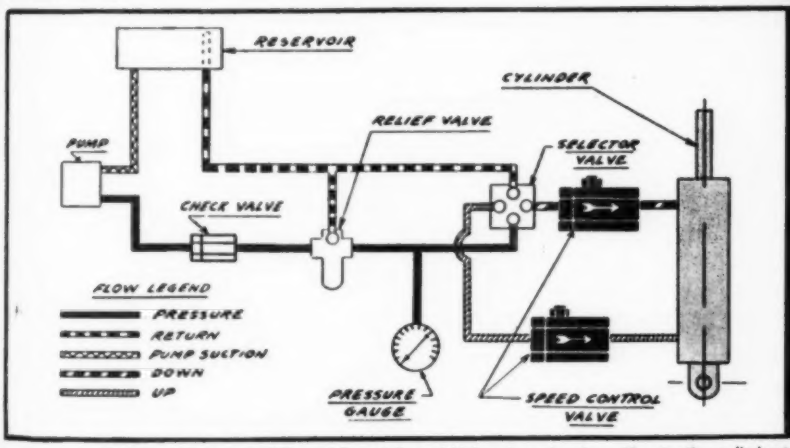


Illustration shows use of Electrol Check Valve in system to prevent loss of pressure through pump when unit is shut off.

ELECTROL CHECK VALVES provide positive sealing from low to high pressures. 5,000 p.s.i. maximum. Standard models feature bronze and brass elements. Special models, steel or other metals best suited to the service required. These valves provide air, gas, water and oil control lines with a minimum of pressure drop and positive sealing against return flow. They are successfully used in the hydraulic or pneumatic systems on busses, trucks, railroads, boats, aircraft, farm and road building equipment, and in a wide variety of industrial installations.

SPEED CONTROL VALVES



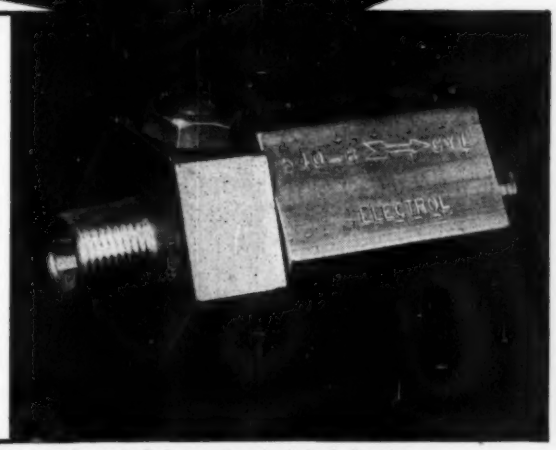


Illustration shows use of Electrol Speed Control Valves in conjunction with actuating cylinder to control speed of piston rod motion in both directions.

ELECTROL SPEED CONTROL VALVES allow flow in one direction and—by use of a metering device—provide controlled flow in the opposite direction. Flow is controlled by a screw-actuated metering pin in the side of the valve. With pressures up to 1,500 p.s.i. and more, this valve handles air and oil—with equal facility—at high or low pressures. Standard sizes ⅛, ¼, ⅜, ½ and ¾-inch NPT ports. Special sizes to order.

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FOR BETTER HYDRAULIC DEVICES

BASIC HYDRAULICS

(Continued from page 19)

from cylinder 1 is thus transmitted into cylinder 2, where it acts to raise piston 2 with its attached platform. When piston 1 is again raised, Figure 13, so that the pressure in cylinder 1 falls below that in cylinder 2, valve 1 will close, preventing return of the liquid and holding piston 2 at its new level. Thus, by repeated strokes of piston 1 we can progressively raise piston 2 and its load as desired. To lower the lift platform, valve 3 is opened, and the liquid from cylinder 2 is returned to tank T.

The reader should carefully verify the fact that the working hydraulic jack is built in conformity with the ideas he has been studying. He should note how, when a force is applied to a relatively incompressible liquid, an equal pressure is set up throughout the liquid, according to Pascal's Law, establishing forces on surfaces directly proportional to their areas, and where these surfaces are free to move, carrying them through distances inversely proportional to their areas.

Hydraulic brakes. A practical application of multiple outlet pistons to distribute forces can be found in the four-wheel hydraulic brake system used on many automobiles, Figure 15. The foot pedal used by the operator is attached to a master input piston. The cylinder in which it moves is connected by tubing to a cylinder at each wheel which contains two opposed output pistons, each of which is attached to a brake shoe fitted inside the brake drum. When force is applied to the foot pedal, pressure is transmitted equally throughout the liquid to all eight output pistons and each piston pushes a brake band against the wall of its brake drum, thus retarding the rotation of the wheel. When the operator lifts his foot from the pedal, pressure in the system is removed and coiled springs return the brake shoes and the output pistons to their original positions.

In this manner, a force applied to the brake pedal will produce a proportional force on each of the output pistons, which in turn apply the brake bands frictionally to the turning wheels to retard rotation. If all eight output pistons were of the same size, the force exerted on each brake band would be exactly the same, provided frictional losses from the master cylinder to each wheel were equal. If the brake bands also were identical each wheel would be equally retarded.

In actual brake designs, however, it is customary to use a greater piston area for the rear wheels than for the front. This produces a greater braking action at the rear in a constant and predetermined ratio and helps to keep the car from slewing around when stopping suddenly on slippery pavements.

Part 3, Introduction, continues in the May issue with "Atmospheric Pressure" and "Input and Output Relations." It is suggested that each installment be preserved for future reference.

PACKINGS AND SEALS

(Continued from page 16)

valve action under shock loads.

The mechanical seal is not handicapped by pressure shock or pulsation. Pressures up to 1000 psi can regularly and safely be handled when properly balanced. Special design and construction are required for higher pressures.

Viscosity. Standard seal construction can be used for viscosities up to 300 SUS. Spring pressures should be increased to prevent excessive film thicknesses, since ability to hold the liquid decreases with an increase in film thickness. The viscosity problem is not a severe one as most hydrauic seal applications fall within the range of 300 SUS viscosity.

Temperature. Most mechanical seals can tolerate temperatures up to 250 F, below which point most hydraulic systems operate. When higher temperatures are encountered, cooling systems or special construction and application are employed to hold temperatures to desirable limits.

Care should be exercised to insure that the pumped material or lubricant contacts the seal face. Early packing designs employed many ingenious devices to keep the lubricant or material sealed away from the gland. In applying seals, the exact opposite practice should be employed. Higher oil levels should and can be maintained. The equipment manufacturer who uses seals intelligently can point out to his customer that considerable savings are possible in maintenance and in replacement of the lubricant.

Shaft rigidity is important; deflection must be kept to the minimum since various changes take place in iron and steel parts if a load is applied and then taken off. Deflection is not a great problem when the load is steady, but the constant changing with operating conditions complicates the matter. Proper alignment means better and longer equipment life.

Summary

Construction is important and every prospective user should fully acquaint himself of the desirable factors and necessary requirements for his particular job and insist that the seal used possesses all of the desirable factors that go to make up a good seal.

Application of the proper seal to the job is the answer to successful performance. Submit your application problems to a qualified manufacturer before you are too far advanced with construction details. Follow the approved layout closely for the specific job it is meant for; thus assure a successful seal application.

From a paper presented at the 1948 National Conference on Industrial Hydraulics, October 1948. Papers are available in bound form by addressing Mr. S. F. Musselman, National Conference on Industrial Hydraulics, Technology Center, Chicago 16, Ill.

KEARNEY & TRECKER CORPORATION

MILLING MACHINES

Kearney & Trecker has specialized in the design and manufacture of milling machines to serve the numerous requirements of the metal working field, and has constantly borne in mind the need for prompt service and maintenance of its products. An enlarged service department has kept abreast of the need for up-to-date information. The data on their machine tools which employ hydraulic mechanisms, is published to direct the attention of those concerned to the information that is available to them on the subject.

No. 1H (12 in and 18 in) Knee Type Manufacturing Milling Machines

General: A high speed machine, particularly designed for production on small parts; available in two sizes of tables with 12 in and 18 in of longitudinal power feed, respectively; spindle speeds in two ranges, 35-1400 rpm (standard) or 60-2400 rpm; table feed range ½ in to 20 ipm with 16 changes; rapid traverse rate 150 ipm; 3 hp.

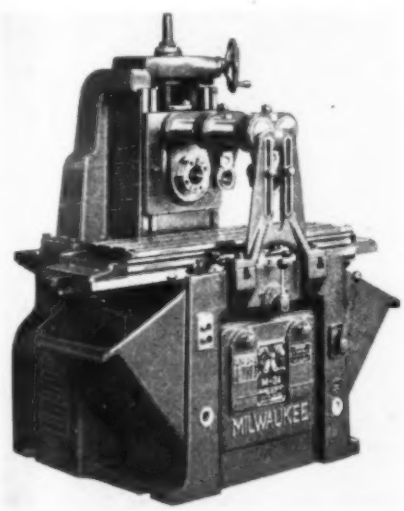
Specifications: See Bulletin No. H-10.

Hydraulic Circuit: Longitudinal table travel hydraulically controlled in feed, rapid traverse, table reversal, return of table in either feed or rapid traverse and automatic spindle stop.

Care and Operation Manual: Catalog HC-10.

Repair Parts Manual: Catalog HR-10. Submit complete serial number of machine when ordering repair parts.

1H-18 in Knee Type Manufacturing milling machine



M-24 Simplex milling machine

M-Series Simplex Bed Type Milling Machines

General: Built to perform a wide variety of milling operations on small and medium sized parts, in single or large lot quantities; complete manual control is available for small lot operations, fully automatic operation for high production work. Machines available in three table sizes with 18 in, 24 in or 30 in of longitudinal power feed, respectively; spindle speeds in two ranges, 20-500 rpm (standard) or 40-1000 rpm; three table feed ranges ¼ to 10 in, ½ to 20 in (standard) or ¾ to 30 in, with 16 changes available in each range; rapid traverse 150 ipm; 5 hp.

Specifications: See Bulletin B-10A.

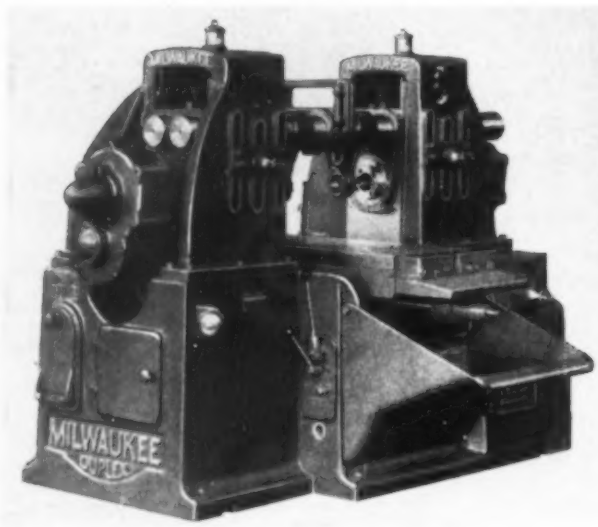
Hydraulic Circuit: Hydraulically actuated clutches for feed, rapid traverse and automatic reverse for two-way cutting cycles. The table control lever is directional, the lever moving the table in feed or rapid traverse rate in either direction. With the automatic spindle stop selector lever the spindle can be started when the table moves at feed rate and stopped when the table moves at rapid traverse rate.

Care and Operations Manual: See Catalog BC-11.

Repair Parts Manual: See Catalog BR-11. Submit complete serial number of machine when ordering repair parts.

MILLING MACHINES

1200-1800 Series Simplex milling machine



1200-1800 Series Duplex milling machine

Hydro-control units are incorporated in the saddle shown here, forming the heart of the hydraulic system in the 1200-1800 series bed type machine.

1200-1800 Series Simplex and Duplex Bed Type Milling Machines

General: A complete line of medium size production milling machines, so designed as to meet the changeable requirements of longitudinal power feed range, table widths and speed and feed ranges; spindle has 7 in of cross and 9 in of vertical adjustment for increased capacity; have adjustable nut on table feed screw to eliminate backlash in both directions, permitting two-way cycle of operation. See specifications below.

Hydraulic Circuit: Hydraulically actuated trip mechanism for controlling the direction and rate of table movement in feed or rapid traverse for various types of intermittent cutting and automatic two-way cutting cycles; one lever controls the rate and table movement, a second lever starts and stops the spindle.

Care and Operation Manual: See Catalog BC-10.

Repair Parts Manual: See Catalog BR-10. Submit complete serial number of machine when ordering repair parts.

SPECIFICATIONS

Milwaukee Simplex and Duplex Screw Feed		1200 Series inches	1800 Series inches
table feeds (power)		18 in 24 in 30 in 36 in 42 in 48 in	.... 24 in 30 in 36 in 42 in 48 in 54 in
Working surface of table	18 in feed	12 x 36 in	.....
	24 in feed	12 x 42 in	18 x 42 in
	30 in feed	12 x 48 in	18 x 48 in
	36 in feed	12 x 54 in	18 x 54 in
	42 in feed	12 x 60 in	18 x 60 in
	48 in feed	12 x 66 in	18 x 66 in
	54 in feed	.....	18 x 72 in
Cross adjustment of spindle		7 in	7 in
Vertical adjustment of spindle		9 in	9 in
Speed ranges—rpm (optional)		20 to 135 *30 to 200 75 to 500 150 to 1000	20 to 135 *30 to 200 75 to 500 150 to 1000
Number of speeds in each range		10	10

*Range furnished as standard

MILLING MACHINES

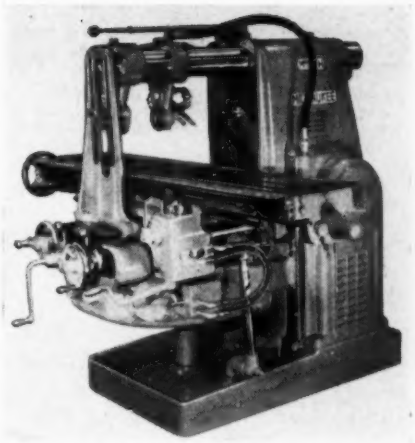
Automatic Cycle Knee Type Milling Machines

General: This line includes 28 machines in plain and vertical styles ranging from No. 2 to No. 5 in size, with horsepower capacity of comparable range from 5 hp up to 50 hp. These machines are equipped standard with mono-lever control for table movement and feed or rapid traverse and are adaptable to the broadest range of milling operations on general manufacturing and mass production work. The machines are available for the efficient use of any type of cutter, including modern cutting tools. They make possible uniform hourly production, minimum idle cutter time and greatly reduces operator fatigue.

Specifications: For complete information on all 28 machines, please consult Catalog AC-10A.

Hydraulic Circuit: Hydraulically actuated trip mechanism for controlling the direction and rate of table movement in feed or rapid traverse to accommodate various cycles required for production work.

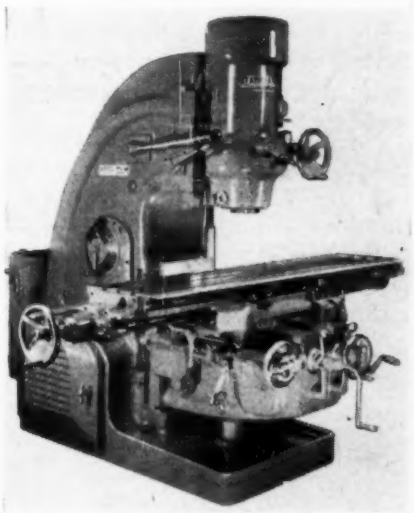
Care and Operation Manuals and Repair Parts Manuals: Consult table below covering all machines in this line.



10hp No. 4H Plain Style Knee Type milling machine with mono-lever table control.

HP	Size and Model		Repair Parts Book	*Care and Operation Book
5 hp	No. 2H	Plain	HR-14	HC-13
7½hp	No. 3H	Plain	HR-15	HC-14
10hp	No. 4H	Plain	HR-15	HC-14
20 hp	No. 5H	Plain	HR-19	HC-15
7½hp	No. 2K	Plain	KR-10	KC-11
7½hp	No. 2KM	Plain	KR-10	KC-10
10 hp	No. 3K	Plain	KR-10	KC-11
10 hp	No. 3KM	Plain	KR-10	KC-10
15 hp	No. 4K	Plain	KR-12	KC-13
20 hp	No. 2CSM		SMR-10	SMC-10
20hp	No. 3CSM		SMR-10	SMC-10
30hp	No. 3CSM		SMR-12	SMC-10
30hp	No. 4CSM		SMR-12	SMC-10
50hp	No. 5CSM		SMR-14	SMC-11
5hp	No. 2H	Vertical	HR-13	HC-13
7½hp	No. 3H	Vertical	HR-16	HC-14
10hp	No. 4H	Vertical	HR-16	HC-14
20hp	No. 5H	Vertical	HR-18	HC-15
7½hp	No. 2K	Vertical	KR-11	KC-11
7½hp	No. 2KM	Vertical	KR-11	KC-10
10hp	No. 3K	Vertical	KR-11	KC-11
10hp	No. 3KM	Vertical	KR-11	KC-10
15hp	No. 4K	Vertical	KR-13	KC-13
20hp	No. 2CSM		SMR-11	SMC-10
20hp	No. 3CSM		SMR-11	SMC-10
30hp	No. 3CSM		SMR-13	SMC-10
30hp	No. 4CSM		SMR-13	SMC-10
50hp	No. 5CSM		SMR-15	SMC-11

*Request Automatic Cycle Supplement



20hp No. 3CSM Vertical Style Knee Type milling machine with mono-lever table control.

GENERAL INFORMATION

Specification Catalogs, published by the Sales Department, contain complete machine descriptions, specifications, design features, applications, photographs, etc. Available on request.

Care and Operation Manuals contain detailed information about care, lubrication and general operational instructions. Available on request at no charge.

Repair Parts Manuals contain complete simplified drawings of the various units incorporated in each machine and a complete index of part names and numbers. Please give serial number when requesting information on a given machine. Write direct to Kearney & Trecker Corporation, 6784 West National Avenue., Milwaukee 14, Wisconsin.

The novel features of all Kearney & Trecker machine tools are protected by patents issued or pending in the United States or foreign countries.

SAVE THIS VALUABLE REFERENCE MATERIAL: BUILD UP A PERMANENT FILE

New PRODUCTS

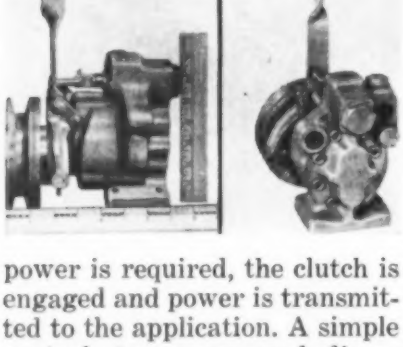
For additional information on any of these products, mark the end key numbers on the card bound in this issue and mail the card.

Hydraulic Control Valves

Hydraulic Equipment Company has developed Series V13 valves for the control of several hydraulic cylinders at the same time. The valves are built around the patented Hollow-Plunger that eliminates momentary load drops and dead spots in valve operation. Providing pressures in the cylinders are equal, this design can be furnished with control plungers for actuating two, three or four-single- or double-acting cylinders at operating pressures to 1400 psi. Outlets are tapped for ½ in connections with maximum capacity of 14 gpm possible. Direct or indirect manual control and many different arrangements for mounting and connection are available. *1.*

Clutch-Type Pump

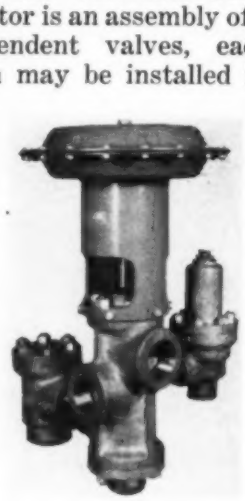
A new, compact, hydraulic clutch-type pump has been developed by Waukesha Hydraulic Corp. The Hydra-Clutch is designed for applications where hydraulic power is desired for intermittent service. When



power is required, the clutch is engaged and power is transmitted to the application. A simple control, to engage and disengage the clutch, is included in addition to an overload relief valve and power source takeoff. Commercial vehicles, road and farm machinery and industrial trucks are naturals for this unit since it can normally operate off the fan belt. *2.*

Two-Pressure Operating Valve

A line of two-pressure hydraulic operating valves for oil or water service is available from The Valv-Trol Co. The operator is an assembly of three independent valves, each of which may be installed in the



position most suitable for simplified piping. Low pressure is admitted to the main or three-way valve through the angle check valve. High pressure is introduced either through the automatic inlet shown or through a diaphragm controlled valve. Steel diaphragm tops, bronze alloy bodies and inner trim of acid and corrosion resistant materials, plus heat-treated discs and seats give long efficient life and make maintenance easy. *3.*

Non-Extrusion Ring Packing

A new ring packing, the Palmetto G-T Ring, which eliminates the damaging effect of extrusion of packing material into the clearance space between the mating parts, is announced by Greene, Tweed & Co. Designed originally for general aircraft reciprocating and static hydraulic service and tested at pressures up to 10,000 psi, the packing is reported as proven applicable for diversified industrial use as seals in cylinders, swivel joints, struts and other applications where high pressures are encountered. All applications except rotary motions are practicable. *4.*

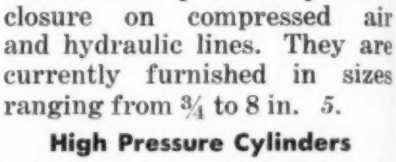
CIRCLE NUMBERS ON THE CARD AND MAIL!

Shut-Off Valve

An improved version of the Warden automatic low pressure shut-off valve in several models is announced by the Security Valve Company. They are recommended for use on liquid or gas lines where shut-off is desired on failure of pressure. A precision lapped synthetic rubber seat provides positive closure on compressed air and hydraulic lines. They are currently furnished in sizes ranging from ¾ to 8 in. *5.*

High Pressure Cylinders

High pressure hydraulic cylinders are now offered in standard models by Miller Motor Co. They are designed for pressures to 2500-3500 psi and are available in 10 and 12 in models in single and double rod end styles. A choice of piston rod seals including the automotive step-cut ring piston seal or the interchangeable low friction cup seal is offered. They conform to the J.I.C. Hydraulic Standards for



Industrial Equipment. Bulletin H104 describes and illustrates this line of high pressure cylinders. *6.*

Plastic Tubing

A new flexible plastic tubing, Temflex 105, approved by Underwriters' Laboratories, Inc., for continuous use at temperatures up to 220 F. has been announced by Irvington Varnish & Insulator Company. For oil resistance, retained dielectric strength, flexibility and elongation after continuous high heat operation, the new tubing offers outstanding properties. This tubing is available in standard

(Continued on page 30)

LETTERS *to the Editor*

I am not an engineer—I am just a fellow who has learned a few things the hard way. About two years ago I became interested in high pressure hydraulics because I could not find a local source of repair for the units in my own shop. As a result we began to develop a hydraulic service, making a start with equipment used by the garage trade. We are trying to build up a hydraulic service capable of rendering a maintenance service on any and all hydraulic equipment that may be used in our territory.

Our field embraces farming, mining (coal and metals) lumbering, milling, manufacturing, power tool applications —in fact the works.

I am just plain greedy for knowledge on this subject of hydraulic power in all its ramifications. Just give me the works on valves, controls, motors, transmissions, applications, etc., in chunks you think I will be able to digest and then add some more just in case you may have underestimated.

C.L.B.

This is one man we will never underestimate! We have given him the "chunk" of material that he asked for. This type of enterprise and enthusiasm is the stuff that builds a business and creates an industry. We will send more "chunks" from time to time!

We are indeed appreciative of your announcement to have a course in "Basic Hydraulics" and particularly on your comment that "no matter how intricate a football team's plays get, they still do their fundamentals." Let's repeat that time and time again! Let's stay simple!

E.M.H.

We wish to congratulate you on the "Beginner's Course in Basic Hydraulics". As far as we are concerned you can't print too much of that sort of material. We hope you plan to print some "test" questions every two or three months so that others like ourselves, can check up on basic ideas.

W.N.C.

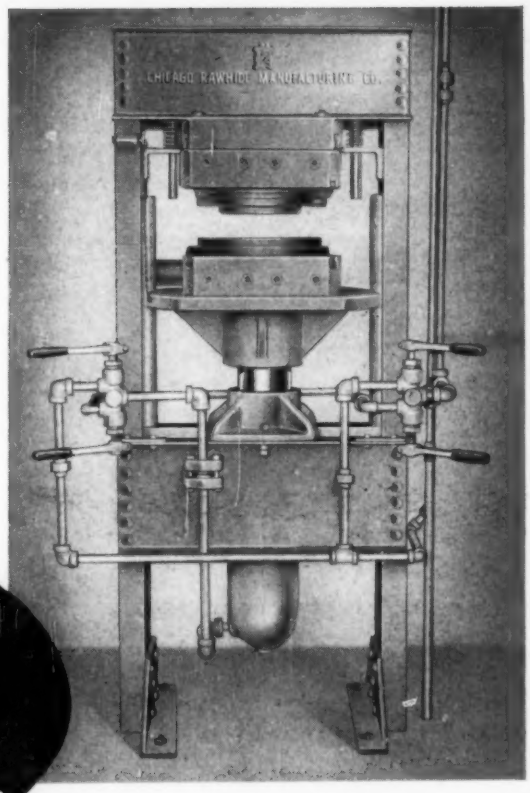
Thank you, gentlemen. We will keep the series simple and we will print "test" questions periodically for the convenience and use of those who will follow through each installment.

As manufacturers of cookers, we perform the cooking operation at atmospheric pressure by carrying steam into the cooker and distributing it directly into the product by means of perforated tubing. Inasmuch as this is a batch cooker, it is necessary to turn the steam off before discharging the product. At the time the steam is turned off (pressure between 5 and 10 pounds), a vacuum is formed in the steam line within the cooker which tends

(Continued on page 35)

IN REPLACING HYDRAULIC PACKINGS

SAVE TIME and MONEY



specify **sirvis**

Replacing the "U" ram packing on a hydraulic press is an expensive procedure. Usually it involves dismantling the press, and the cost of installation is much greater than the cost of the packing itself. So, it's sound practice to use the best packing available. Actual tests prove that Sirvis "U" type packings deliver maximum service. On the hydraulic press illustrated, a Sirvis leather packing functions as the pressure sealing unit. Despite the extreme pressures and the action of hydraulic fluid in this application, the Sirvis packing requires less replacement than any other type. Sirvis will solve your packing problems with similar economy and service. The next time you install or replace hydraulic packings, specify Sirvis.

• ***SIRVIS PACKINGS** are engineered from top grade steerhide, specially tanned and treated. They are scientifically designed for all types of mechanical applications.*

MECHANICAL LEATHER PRODUCTS

sirvis

OTHER C/R PRODUCTS
PERFECT Oil Seals
SIRVENE Synthetic Rubber

CHICAGO RAWHIDE MANUFACTURING COMPANY
1301 Elston Ave. Chicago 22, Illinois
New York · Philadelphia · Detroit · San Francisco · Cleveland · Boston
Pittsburgh · Los Angeles · Cincinnati · Minneapolis · Syracuse · Peoria

(Continued from page 28)
lengths and in coils, in standard electrical code colors and sizes .208 to 2 in ID. *7.*

Manual Control Valve

A new line of manually actuated, 4-position, dual pressure control valves is announced by Saval, Inc. They are designed for use on accumulator actuated high and low pressure presses employing water or oil as a pressure medium. Saval's Shear-Seal principle is incorporated and fast one-hand operation is possible through the use of a single lever; throttling on the low pressure line is possible, with an intermediate shut-off position provided. Four sizes are provided from ¾ to 2 in for pressures to 7000 psi. *8.*

High Pressure Valves

Emmett Machine & Manufacturing, Inc. announces a complete line or diaphragm-activated two-pressure valves.

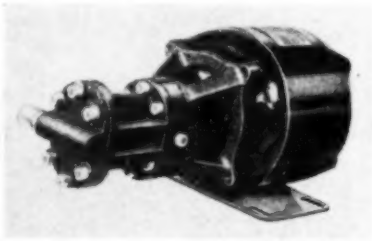
The "Merit" valves range in size from 1 to 4 in for systems operating on pressures of 3000, 5000 and 10,000 psi. Variations of valve assembly provide for diaphragm - controlled high-pressure inlet, slow-travel valve or stop valve in one casting and with minimum pipe connections. Seats and discs between main valve and check valve assembly are interchangeable and are of heat-treated Monel, virtually eliminating electrolysis. *9.*

Hydraulic Sequence Valve

Gerotor May Corp. has added a new sequence valve to its line of oil hydraulic valves. This new Model 8822 valve incorporates many improvements such as hydraulically balanced piston with large bearing surface; spring guide; hardened, lapped plunger; single diameter bore; and large diameter plunger. Direct operated, these valves are available in two pressure ranges of 50 to 500 psi and 500 to 1500 psi and in seven sizes from ¼ to 1½ in. Catalog section 201 illustrates and describes the valve. *10.*

Gear Pumps

A new GW series gear pumps is now ready for the market according to the manufacturer, Eastern Industries Inc. De-



signed for handling small volumes of non-lubricating liquids at relatively high pressures the GW pumps are available in ½ and 1 gpm capacities at operating pressures up to 200 psi. Of bronze construction with hydraulically balanced graphite impregnated carbon bearing and mechanical seal, the units are offered with belt driven or flexible coupling drives.

Also available are positive displacement, rotary vane pumps designed for the same liquid mediums. *11.*

Time-in-Process Recorder

The Bristol Company has developed a new recording and indicating device for time-in-process readings. The instrument gives a reading on a uniform scale, directly in terms of the total time consumed during a process. These readings are given directly and thus no calculations are required. *12.*

Repeat Cycle Timer

G. C. Wilson & Co. is offering a newly developed repeat cycle timer for use on automatically operated equipment. It is an electronic device employing a vacuum tube circuit and operates through the charging of two resistance-capacitance networks. The off and on cycles are variable over a range to 200 seconds for on and 60 seconds for off. The standard unit is ac but dc versions are also available. *13.*

CIRCLE NUMBERS ON THE CARD AND MAIL!

Air Operated Toggle Clamp

An air operated toggle clamp with special finger and operating links is available from Lapeer Mfg. Co. These features provide an inverted plier action for positioning many parts for assembly work. The clamp has a holding pressure of 400 psi with a line pressure of 85 psi. The air cylinder is double-acting, the toggle action holds until the cylinder is reversed. This clamp can be used singly or in multiple from a central air control. *14.*

Inside Micrometer

Rimat Machine Tool Company manufacture handy, direct reading micrometers for internal measurements. These pre-

cision tools are offered in nominal ranges from ½-9/16 in to 6-12 in. Special sizes can be made to order. It is possible to mike grooves and deep holes and often eliminate plug gages for short runs. The company also offers duplex micrometers and microdapters. *15.*

Motor Starters

General Electric Company, Apparatus Dept. announces a complete new line of fully enclosed motor starters. Designed for long life and easy maintenance, these starters incorporate new type contacts, arc hood, magnet, armature and coil. Units are available for NEMA sizes 0, 1, 2, 3 for ac motors to 50 hp. *16.*

(Continued on page 35)

THEY FLOAT!

WHAT: *bearings in a Pesco Hydraulic Pump*

WHY: *to constantly maintain minimum end clearance*

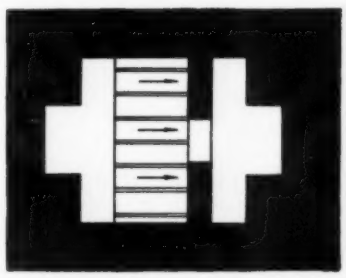
HOW: *by means of "PRESSURE LOADING"*

RESULT: *volumetric efficiencies up to 97%*
. . . torque efficiencies up to 90%

"Pressure Loading" is an exclusive, patented Pesco principle of construction for gear type hydraulic pumps. By *automatically* holding end clearance to a thin film of oil, maximum torque and volumetric efficiencies are obtained under all operating conditions. New pump efficiency is maintained throughout the long service life of the pump since "Pressure Loading" provides an *automatic* take-up of wear.

THIS IS "PRESSURE LOADING":

The schematic illustration at right shows the three principal parts of a gear type hydraulic pump. They are the bearings ("A" and "C") and the gear ("B"). Bearing "A" is fixed. Bearing "C" "floats". By means of the "Pressure Loading" principle, pressure from the discharge of the pump is transmitted through a "pressure loading" passage and is exerted against the rear of the "floating" bearing (arrows). This force is counterbalanced by the pressure developed within the gear cavity so that the thrust of the bearing against the gears is just enough to accomplish its purpose.



REMEMBER: *Only Pesco Hydraulic Pumps are "pressure loaded"!*

If your product uses, or can use the sales power of hydraulic power, be sure to get the full story of "Pressure Loading" and what it means to the efficient, economical operation of your product. Write for the booklet "Pressure Loading by Pesco". There is no obligation.

Pesco PRODUCTS DIVISION
BORG WARNER CORPORATION
11610 Euclid Ave. - Cleveland 6, Ohio

MANUFACTURERS OF BW SUPERCHARGERS

Useful Literature

The publications listed are available without charge. Mark the initial key number on the card bound in this issue and mail.

25. Fluid Motors . . . Bulletin No. 124 on HydrOILic Fluid Motors made by The Denison Engineering Company describes the design features and operating advantages of the "Floating Drive" units. Two sizes, available with or without speed control valve and geared head drives (gear ratios of 3:1, 1:3, 1:1.5 and 1.5:1) are rated at 3 and 5 hp at 1500 rpm and constant operating pressure of 1000 psi.

26. Filters . . . Cuno Engineering Corporation, in a series of single-page bulletins, describes their line of Auto-Klean and Air-Line filters. All of the filter designs incorporate the edge filtration principle — effective filtration by passing a fluid between strips of metal. Numerous types of the all metal filter are available for practically any type of hydraulic lubricating or fuel oil service. Capacities, operating pressures and other data are given for each type.

27. Air Compressors . . . Single and two stage air compressors in several types of mountings are produced by Curtis Pneumatic Machy. Div. of Curtis Manufacturing Co. They are reviewed in Catalog C-94 with photographs, design drawings and construction features. The mountings are horizontal, vertical, separate base and portable. Capacities of the single stage units range from 1.35 to 9.06 cu ft displacement; for two stage from 4.9 to 43.3 cu ft displacement. Design features of the single stage duplex and two stage compressors are given in detail. Accessories are also shown.

28. Bearing Bronze . . . Full physicals and analyses of the Promet "engineered" bronze alloys for bearing and wearing parts made by The American Crucible Products Co. are available in booklet form from the manufacturer. Promet bronze is available in bar and bushing stock and in castings of any size, shape or section up to 2000 pounds each and is supplied in rough, semi- or full-finished parts.

29. Hydro-Check . . . A new bulletin, "Hydraulic Checking of 'Controlled-Air-Power' ", gives full design and application data on the adjustable hydraulic resistance unit offered by The Bellows Company. The Hydro-Check sets up a resistance to the power thrust, smoothing out the natural springiness of air. It may be used to check the movement of an air-powered piston or machine at any given point or points or to stop and re-start movements. Available in six sizes, the unit is readily incorporated into hand feed or air power circuits.

30. Hydraulic Pumps . . . The hydraulic radial type plunger pumps, produced by Superdraulic Corporation, are described and illustrated in an 8-page bulletin prepared by this company. Capable of developing 5000 psi and 40 hp the pump is available in both constant and variable delivery models. The pump delivers 0 to 17 gpm at 1200 rpm and can be arranged in multiple to meet requirements. Typical circuits and installation drawings are given.

31. Tube Fittings . . . Scovill Manufacturing Company has published a bulletin describing their line of Uniflare self-flaring tube fittings. These fittings are suitable for use on annealed steel, aluminum, monel, brass and copper tubing and are available in sizes ranging from ⅛ to 1 in. Incorporating a 37 degree flare, this fitting design is reported to eliminate both preliminary flaring operation and wasteful tube cracking.

32. "O" Ring Data . . . A new engineering manual, "John Crane Hydraulic 'O' Rings," is now being distributed by Crane Packing Company. The manual contains tabulations of compound specifications, dimensional standards and data on applications and installations. Also included is complete information and drawings on typical problems of "O" ring usage.

33. Solenoid Valves . . . Condensed Catalog No. 200-R, issued by Automatic Switch Co., discusses briefly the many types of solenoid valves offered. Manually reset safety shut off and trip, electrically opened and closed shut-off, 2- and 3-way pilot controlled and packless valves are shown. Special valves, filters and strainers, as well as typical valve applications are also shown.

34. In-Line Valves . . . A new illustrated bulletin on full-flo, in-line valves available from Ross Operating Valve Company. This Bulletin No. 311 describes and illustrates the large and small, three-way and straightway valves recommended for machine tools, jigs and fixtures, etc. The large sizes are solenoid, air-piloted operated while the small sizes are direct solenoid operated.

35. Shaft Seals . . . Roto-Flex rotating shaft seals are manufactured by Gits Bros. Mfg. Co. and are described and illustrated in an 8-page bulletin issued by this company. They are recommended for such applications as pumps, compressors and a wide range of industrial equipment. The seals feature balanced design, built-in flexibility, fewer parts (three components) and easy installation. Standard sizes for shaft diameters from ⅜ to 4 in, single and double seals, are available.

36. Power Unit . . . Rapidraulic Junior, a hydraulic clamp unit produced by John S. Barnes Corporation, is described in

Bulletin 305-U. The compact, self contained unit is designed for rapid operation and high (500 psi) holding pressure. Equipped with Barnes Constant-Flo rotary gear pump, valves, filter tube for motor drive, the unit is mounted on its own base for convenient machine or floor mounting. Two models are available with manual valve and 2-position, solenoid operated valve on tank.

37. Sump Type Filters . . . The sump type synclinal filters made by Marvel Engineering Co. are reviewed in Bulletin No. 103, now available from this company. The synclinal design provides three times the capacity of comparable size units, is very simple in construction, can be easily cleaned and is adaptable to tandem and multiple installation arrangements. Five models are available for pipe sizes ¾ to 1½ in with 7 to 18 serrations.

38. Hydraulic Oils . . . A bulletin on the Hydro-Drive "MIH" series of hydraulic oils has been issued by E. F. Houghton & Co. The physical requirement of petroleum oils used for hydraulic purposes and the advantages of the Hydro-Drive MIH oils over straight petroleum oils in hydraulic service are given in some detail in the bulletin, prepared by the Houghton research staff.

39. No-Thread Fittings . . . Dresser Manufacturing Division, Dresser Industries, Inc., gives full design and application data on their Style 65 No-Thread Fittings in 16-page booklet, Form 418B. Step-by-step procedure is shown in series of photographs. A table of gasket recommendations and list prices are included.

40. Air Compressors . . . The 1949 edition of the Wayne Pump Company's air compressor bulletin is now available. The new two stage 7½ and 10 hp models are shown and described. These two sizes provide, respectively, 30 and 40 cfm displacement at 175 psi and 37 and 50 cfm at 100 psi. They are four cylinder units of the V-type and are available mounted on bed-plate or tank as required. These compressors are equipped for fully automatic operation with pressure control switch, pressure gauge and across-the-line starter. Other single stage, two stage and low pressure stage compressors in the Wayne line are also shown. Application and design illustrations and complete model specifications are included.

41. Cylinders . . . A 12-page bulletin gives special features and specifications of cylinders for air, hydraulic and water service made by Ortman-Miller Machine Co., Inc. Tie-rodless construction, internal locking, self aligning and regulating cushions, interchangeable mounting brackets and ability to orient ports at random without disassembly are features noted. Specifications are given for six models, each available in 150 psi air or 500 psi hydraulic and 500 psi air or 1500 psi hydraulic pressures, bore sizes 1½ to 8 in, in six types of mountings.

Correction

The hydraulic analogy in Fig. 2 of *"A Beginner's Course in Basic Hydraulics"* (March, page 8) is incorrect, as several readers have pointed out. The pressure and area relation should be reversed. The text (pages 9-10) should read . . . "a force of 50 pounds applied over a certain area can balance a force of 100 pounds acting over *twice* that area." Please correct your reference copy.

These Inexpensive Air Powered Units Can Double the Output of Standard Machine Tools

PRODUCTION of such standard machines as drill presses, tapping machines, milling machines, etc., is frequently more than doubled by the use of inexpensive Bellows "Controlled-Air-Power" Devices.

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POST SCRIPTS OF INDUSTRY

NEWS · VIEWS · TRENDS

D. M. J. Tracey, general manager, The Tomkins-Johnson Co., Jackson, Mich., states that the company has engaged J. R. Elder as field representative.

Charles T. Morgan, 21 Lothrop St., Beverly, Mass., has been appointed New England sales representative of Sperry Products, Inc., Danbury, Conn. Mr. Morgan will specialize in marine and industrial applications of Sperry hydraulic remote controls and ultrasonic instruments.

R-S Products Corporation, Philadelphia, announces the appointment of Trident Engineering Company, San Francisco, as representatives of their Valve Division.

Richard E. Hitchcock has been appointed field engineer and sales representative for Hannifin Corporation of Chicago, in the New York area, according to an announcement by Ellwood G. Peterson, president.

The Sun Oil Company, Philadelphia, has named Ray H. Anders as director of purchases. Mr. Anders has been, until recently, manager of the company's industrial products department.

The New York Air Brake Company announces the appointment of B. R. Teree as director of engineering, hydraulic division. Mr. Teree will headquarter at Watertown, N. Y., and in addition to direction of engineering activities for the hydraulic division, he will continue his services to the aircraft technical committee of S.A.E.

At a recent Board meeting R. L. deBrauwere was elected assistant vice president of Scovill Manufacturing Company. He continues as assistant secretary of the Scovill Manufacturing Company and as secretary and director of A. Schrader's Son, Incorporated, Brooklyn, N. Y. Widely known in the rubber industry, deBrauwere has been with Schrader's since 1915 and as general sales manager from 1925 to 1940. He has been assistant secretary of Scovill since 1934.

Hydropress, Inc., New York, has appointed Carl E. Haugh as district sales manager of its Eastern and Mid-Western Divisions. With many years of experience in the hydraulic field, Mr. Haugh has been with Hydropress for the past three years as sales engineer.

(Continued on page 40)

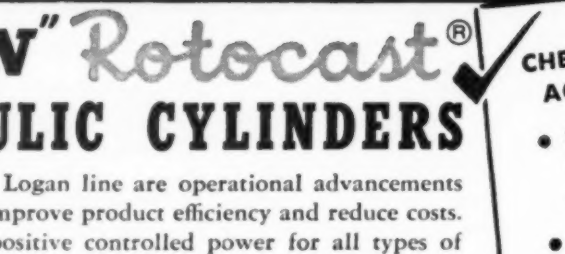
* Fluid Power Improves Production

"LOGAN" Rotocast® HYDRAULIC CYLINDERS

Built into this new Logan line are operational advancements that will help you improve product efficiency and reduce costs. Here's fast-acting, positive controlled power for all types of industrial applications.

7 STANDARD MOUNTINGS

• Rabbited • Foot • Center Line • Clevis • Trunnion • Flange at blind end • Flange at rod end—or any desired combination.



*ENGINEERING COUNSEL

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Logan Rotocast Cylinders properly conditioned can also be used for water service.

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VALVES · CYLINDERS · VALVES · PRESSES · SURE-FLOW COOLANT PUMPS

FLUID POWER SPECIALISTS SINCE 1916

(Continued from page 30)

Air Valve

A redesigned panel-type pneumatic operating valve is offered by Marton Air Valve Equipment Div. of Marton Equipment, Inc. The unit incorporates filter, oil level and pressure gages, pressure adjustment and operating lever all mounted on the front of the panel. The panel is designed for machine mounting and pressure applications to 220 psi on the inlet side. *17.*

(Continued from page 29)

to such the product through the perforated openings back into the steam line. We want to avoid this. Can you suggest any of your advertisers who may be able to furnish a valve which we could install in the steam line after the shut-off valve, which, when the vacuum was created, would admit air and prevent the vacuum sucking the product back into the steam line. The fact that the product gets into the steam line causes a very unsanitary condition and increases the difficulty of cleaning out the unit.

R.T.M.

One of the manufacturers to whom this problem was sent suggests: "a fairly simple remedy might be the use of two stainless steel check valves, placing one on the steam line and the other to atmosphere."

We read the article by Mr. Tommy J. McCuistion, commencing on page 14 of the February issue of APPLIED HYDRAULICS and have several questions we would like to ask him concerning the use of "O" rings.

P.S.D.

The questions and Mr. McCuistion's answers, printed by permission, follow:

1. Are rubber "O" rings suitable for use where the "O" rings must pass over a port during the pressure stroke? For example, is it possible to use a rubber "O" ring in a valve assembly where the opening of the valve occurs when the "O" ring emerges from a cylindrical area into an open area?

Answer: In some cases success has been obtained where the ports are 1/32 in diameter or less and the pressure is under 200 psi. Also, some degree of success has been obtained by using a confined groove as described in my article in the December issue of APPLIED HYDRAULICS. However, it is usually a very difficult problem to work out satisfactorily and other methods of handling the problem are cheaper in the end.

2. Have "O" rings proved suitable in reciprocating applications where water is a lubricant? Have they also been used where a somewhat abrasive fluid is encountered?

Answer: Yes. Special rubber compounds are sometimes necessary. I am not sure what is meant by "abrasive fluids". Abrasives in a fluid may cause trouble by scoring the metal surface and as a result the "O" ring will wear rapidly. The amount of wear will depend on such factors as pressures, type and amount of abrasive material present and clearance between the metal parts.

3. Assuming water lubrication without serious abrasive in the water, would "O" rings be suitable in a plunger reciprocating pump where the speed was on the order of 500 strokes per minute?

Answer: In my opinion, no. If long continuous service is expected, the heat built up at that speed would cause the "O" ring to wear very rapidly.

I am a maintenance man in the lubrication department and I find that some of the technical bulletins on hydraulic systems are a little on the abstract side as far as the math is concerned. I get annoyed when the math makes "blind spots" in an explanation. Is there a shop type of text or manual that covers the math used in hydraulics (leaving out theoretical design)?

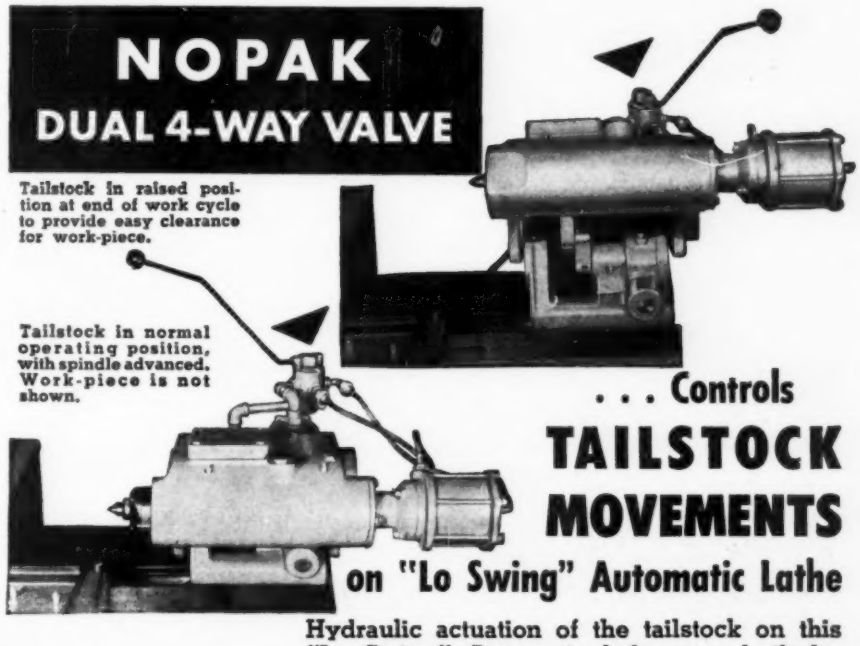
E.H.

We do not know of such a text or manual. A book being written may come close to what you have in mind. We expect to review it as soon as it comes off the press.

To J.F.B. in the November issue

The author and subject index to the articles published in APPLIED HYDRAULICS in the first year have been sent you. A limited number of copies are available to readers on request.

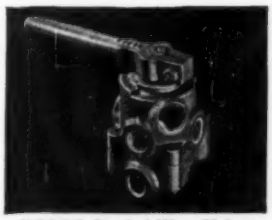
NOPAK
DUAL 4-WAY VALVE



Tailstock in raised position at end of work cycle to provide easy clearance for work-piece.

Tailstock in normal operating position, with spindle advanced. Work-piece is not shown.

. . . Controls
TAILSTOCK MOVEMENTS
on "Lo Swing" Automatic Lathe



NOPAK Dual 4-Way Valve, the equivalent of two 4-Way Valves. Controls the action of two double-acting cylinders with a single operating lever.

Hydraulic actuation of the tailstock on this "Lo Swing" Automatic lathe . . . built by Seneca Falls Machine Co. . . . greatly reduces loading and work-removal time. One NOPAK Dual 4-Way Valve controls two hydraulic cylinders which provide power for the following four movements comprising the work cycle: — 1- Lowering tailstock unit to operating position; 2- Advancing tailstock spindle; 3- Retracting tailstock spindle; 4- Raising tailstock unit for clearance.

These movements are conveniently governed by easy manipulation of the extended lever on the NOPAK Dual 4-Way Valve which actuates both cylinders. This valve may be the answer to one of your "dual control" applications.

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Applied HYDRAULICS DIGEST

Abstracts, summaries and listing of articles on hydraulic and associated applications in industry; reports on prepared papers, talks and discussions of special interest to the hydraulics field.

Development and Testing of Fire Resistant Hydraulic Fluid

D. H. Moreton, paper presented at SAE Annual Meeting, Detroit, Mich., January 14, 1949.

Prepared from the preprint.

This paper presents the pertinent features of the program followed by the Douglas Aircraft Company in a effort to find a more fire resistant hydraulic fluid for use in commercial air trans-

PROTECT HYDRAULIC MACHINES *Where Trouble STARTS!*

★ Chief Engineer ★ Hydraulic Engineer
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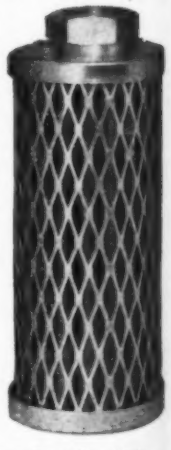

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ports. From a survey began in 1946, a screening and preliminary testing divided assembled fluids into five basic types: two petroleum-base; one silicone-base; two halo-genated-hydrocarbon type; three water-base (one in a fairly advanced stage of development); and three ester-base fluids. The bulk of the report is devoted to charts and graphs on the performance tests and fluid development program. This latter was based principally on the ester-based materials. A third phase of the program was: (a) a study of the evaluation of presently used packings and gaskets expected to operate in the new fluid and; (b) the effect of the fluid on the elastomeric and plastic insulating, gasketing and sealing materials. Flight tests with the ester-type DMX-8, the most promising of the fluids tested, are now in progress. Two groups of conclusions, one presenting technical conclusions the other economic aspects, are given.

Tips on Finding Leaky Air Valves

Fred J. Ardolino, *Operating Engineer,* v 2, January 1949, pp 40-41.

A simple procedure for finding leaky air compressor valves on a two stage compressor with three unloader valves is outlined. To check the high pressure discharge valve, close stop valve, remove check valve disc and then open stop valve. If air escapes from the intercooler drain, the valve leaks. When pressure is built up in intercooler, close valve on line from receiver, disconnect and plug intercooler-unloader pipe, open the valve and stop the compressor. If air blows through intake filter, the low pressure valve or valves leak. Since the unloaders may leak back into the cylinder, check unloader discs by shutting down the compressor with check valve in and stop valve closed and opening the drain valve in the intercooler. If air leaks, either the high pressure cylinder unloader or intercooler unloader is at fault. Remove one, then the other unloader. With leaks stopped after this check, air leakage from the air filter means the low pressure unloader is leaking.

Application of Hydraulic Remote Control to Farm Implements

E. W. Tanquary, *Agricultural Engineering,* January 1949, pp 17-19.

This is the report of the Advisory Engineering Committee, Farm Equipment Institute, presented at the winter meeting of the American Society of Agricultural Engineers at Chicago, Ill., December 1948.

After defining the objectives of standardization, the Committee presented the proposed ASAE Standard, "Application of Hydraulic Remote Control to Farm Tractors and Trailing-Type Farm Implements." Fifteen standard dimensions and specifications are proposed to permit use of any make or model of trailing-type farm implement adapted to hydraulic re-

The best hose you can buy is usually the cheapest in the long run. For a top grade hose stands up. It keeps fluid or gas flow under complete control despite constant flexing, vibration, pulsating loads. Such a hose offers greater security against costly replacements, circuit troubles, customer complaints. No wonder so many well-known manufacturers today rely on Resistoflex assemblies!

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(Continued from page 37)

mote control with the cylinder furnished with any make or model of farm tractor up to and including 35 maximum drawbar horsepower and to eliminate the necessity of supplemental hose lengths or piping for certain types of implements which will facilitate changing the cylinder from one implement to another, and reduce the possibility of introducing dirt or foreign material into the hydraulic system.

Speed Control for Electrical Drives

R. B. Immel, *Product Engineering,* v 20, January 1949, pp 131-160.

A very complete survey of performance characteristics with 21 methods of electrical speed control analyzed and graphically compared. Forty-four graphs and circuit diagrams and a fold-in table summarizing the speed control characteristics are included.

How the Torque Converter Works

Oliver K. Kelley, *SAE JOURNAL,* February 1949, pp 22-25.

This is based on a paper, "The Polyphase Torque Converter," presented at the SAE Philadelphia Section, Oct. 13, 1948.

A simple, clear development of the mechanics of the hydrokinetic drive. The fluid coupling, the single stage and the polyphase torque converter

FLOW CONTROL VALVE for Cylinder Speed ADJUSTMENTS over a WIDE RANGE IN AIR OR HYDRAULIC USE

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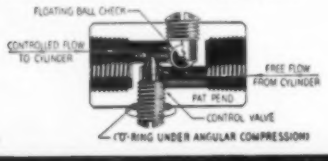

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are analytically examined in turn. The principle of torque multiplication is illustrated both in an ideal turbine and in a practical converter with modifications made to minimize the energy and shock losses. The relation of pump torque to turbine torque, the importance of turbine exit angles and the curvature of pump vanes are pointed out. A design of a polyphase converter is arrived at in which the pump speed times its torque divided by the turbine speed times its torque gives an overall efficiency of 88 percent. A design factor not yet solved is a mechanism for constantly changing the entrance angle for its members. One commercial solution, the Buick Dynaflow, makes three modifications to the entrance angles, which with the original starting setup, gives four phases of operation.

Standards of Hydraulic Institute

The eighth edition of the Standards of Hydraulic Institute, issued in six parts gathered together in a loose leaf binder, has been expanded and brought up to date. New data has been added to each of the centrifugal (57pp), rotary (21pp) and reciprocating (28pp) pump sections. The new data section is substantially the same minus the pipe friction data. The pipe friction data, incorporated in a new section, is based on Paper No. 44-SA-4, "Friction Factors for Pipe Flow," published in the 1944 ASME Transactions. This section is issued as a Tentative Standard.

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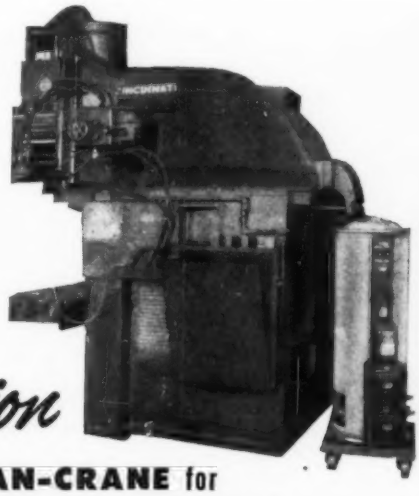

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Champion Machine and Forge Company, Cleveland, uses Honan-Crane oil purification equipment to keep hydraulic oils clean in Champion's nine Hydrotels used for die-sinking.

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For full information on low cost purification and maintenance of hydraulic oils, write Honan-Crane Corp., 102 Wabash Avenue, Lebanon, Indiana, subsidiary of Houdaille-Hershey Corporation.

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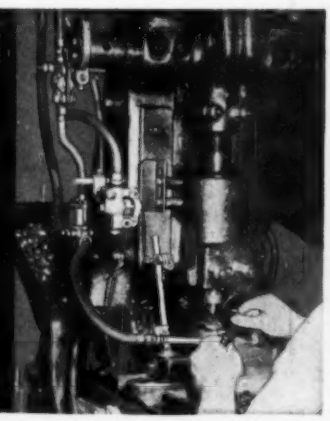

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Got a problem in ejection of parts? You can lick it with a Schrader Air Ejection Set. These sets are low in price, amazingly easy to install, and result in higher production with greater safety to the operator. Because they operate on an intermittent principle these sets pay for themselves in a short time through tremendous savings in air. And they require little or no maintenance. Several types available for various phases of work . . . fit any power press or any other machine to which an actuating cam or sliding tripper can be applied. Write for your copy of the Schrader air ejection set folder today.

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DIVISION OF SCOVILL MANUFACTURING COMPANY, INCORPORATED
488 Vanderbilt Avenue Brooklyn 17, N. Y.

PSI

(Continued from page 34)

C. E. Gobeil Company, 2635 University Ave., St. Paul, Minn., has been appointed exclusive representatives for Hydro-Line Mfg. Co. of Rockford, Ill., in the states of Minnesota, North and South Dakota and western Wisconsin.

George A. Starbird, president of Meletron Corporation, Los Angeles, announces two recent additions to his staff: Ray McDowell as a sales assistant and Wyatt Dawson as office manager.

Watson-Stillman Company has appointed Richard W. Schreck as Michigan divisional sales representative, according to an announcement made by A. G. York, vice president in charge of sales. Mr. Schreck will headquarter in the Chicago office of the company and be under the direction of F. G. Helander, district manager. In addition to his duties in Michigan, Mr. Schreck will act as special consultant on hydraulic machinery for The Frank T. Goetz Machinery Co., Cleveland and W. K. Millholland Machinery Co., Indianapolis.

Twin Disc Clutch Co. recently completed construction on a new warehouse building at 1214 Westlake Ave., North Seattle, Wash. to increase their service facilities for their customers in the Pacific Northwest. A. E. Young is West Coast manager, Paul W. Wahler is assistant district manager at Seattle.

Askania Regulator Company, Chicago, announces the appointment of Frank E. Early as its representative in the Detroit industrial area for all of the products of the company.

The Iowa Institute of Hydraulic Research will hold its Fourth Hydraulic Conference at Iowa City June 12-15. Hunter Rouse, director, announces five technical sessions will hear 13 correlated papers, a symposium on present day principles and methods of analysis.

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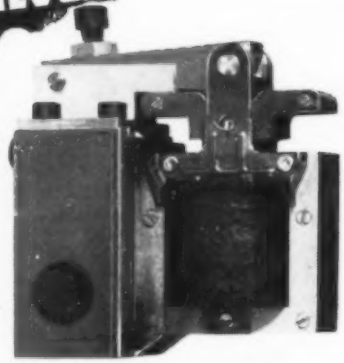
NEW HIGH PRESSURE
SOLENOID VALVES

FOR 110-VOLT 60 CYCLE A.C. CURRENT

Features

- Rugged compact construction
- 3000 P.S.I. operating pressure
- Continuous duty
- Poppet design eliminates leakage
- May be mounted in any position
- Impregnated coils resist moisture and condensation



Waterman High Pressure Solenoid Valves are inexpensive, compact units designed for continuous duty in hydraulic systems where pressures are as high as 3000 P.S.I. Poppet type construction gives positive sealing against internal leakage. Impregnated oil resistant coils make these valves suitable for mounting in oil reservoirs. In many cases this feature eliminates costly piping and makes possible the construction of smaller, more compact hydraulic power units. Available in ¾" pipe size. Electrical requirements are 110 volt—60 cycle A.C. current.

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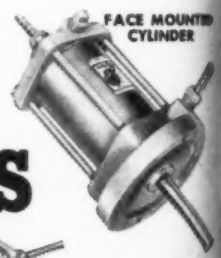
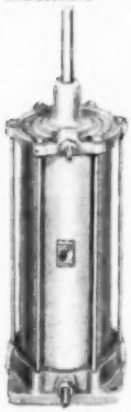


HORIZONTAL MOUNTING

VERTICAL MOUNTING



SUSPENDED OR SWIVEL MOUNTING

Mounting	Bore				
Horizontal	1½"	2¼"	3"	4"	5"
Vertical	1½"	2¼"	3"	4"	5"
Face	1½"	2¼"	3"	4"	5"
Swivel	1½"	2¼"	3"	4"	5"

Length of stroke optional

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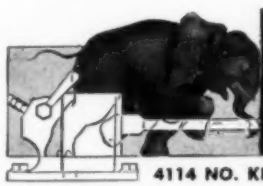

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